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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY NEW ENGLAND - REGION I 1 CONGRESS STREET, SUITE 1100 - HBR BOSTON. MA 02114-2023

March 10, 2004

Mike Webster GeoInsight, Inc. 319 Littleton Road, Suite 105 Westford, MA 01886 PREAK: 26 REL
OTHER: 464413

Re: Administrative Order on Consent for Removal Action: Wells G&H Superfund Site, Olympia Nominee Trust property, Woburn, Massachusetts (CERCLA Docket # 01-2003-0023)

Dear Mr. Webster:

EPA is in receipt of the document entitled "Revised TCE Work Plan, Removal Action, 60 Olympia Avenue, Woburn, Massachusetts" and dated January 28, 2004 pertaining to the cleanup of TCE contamination at the above-referenced site and submitted by you under the Order referenced above. Pursuant to paragraph 30 of the Order, EPA has determined that this Work Plan is conditionally approved. You shall perform all required actions in accordance with the Work Plan and the schedule in the Scope of Work and the following conditions listed below:

- 1) Ground water monitoring during implementation of the cleanup shall include permanganate monitoring via either qualitative (i.e. color) or quantitative means.
- 2) In order to adequately treat TCE contamination in the southwest quadrant of the containment area, where the contamination extends towards the sewer lines, it may be necessary to extend the delivery system westward, closer to the sheet piling. EPA suggests adding another injection point and lengthening the injection trenches a shown on Attachment A.
- 3) The monitoring well network within the sheet pile containment area shall include at least twelve monitoring well clusters located approximately as shown in Attachment A. These monitoring points can be made up from existing wells and/or new wells.
- 4) The monitoring well network outside the sheet pile containment area shall include at least nine monitoring well clusters located approximately as shown in Attachment B. Each cluster shall include at least three screens installed as follows: (a) the shallowest screen below the water table and within the silt layer, (b) the middle screen extending down from the toe of the sheet piling, and (c) the deepest extending to at least 50% deeper than the bottom of the sheet piling.

5) EPA is concerned about the possibility of permanganate solution escaping from the containment area either through the joints and/or under the sheet piling. The contingency plan discussed in Section 7.7 shall address these possibilities.

Pursuant to you request, EPA also hereby extends the due date for the "Final Report" required per Paragraph 35 of the Administrative Order on Consent until April 2, 2004. If you have questions concerning the matters discussed herein, please contact me at (617) 918-1278.

Sincerely,

Frank Gardner

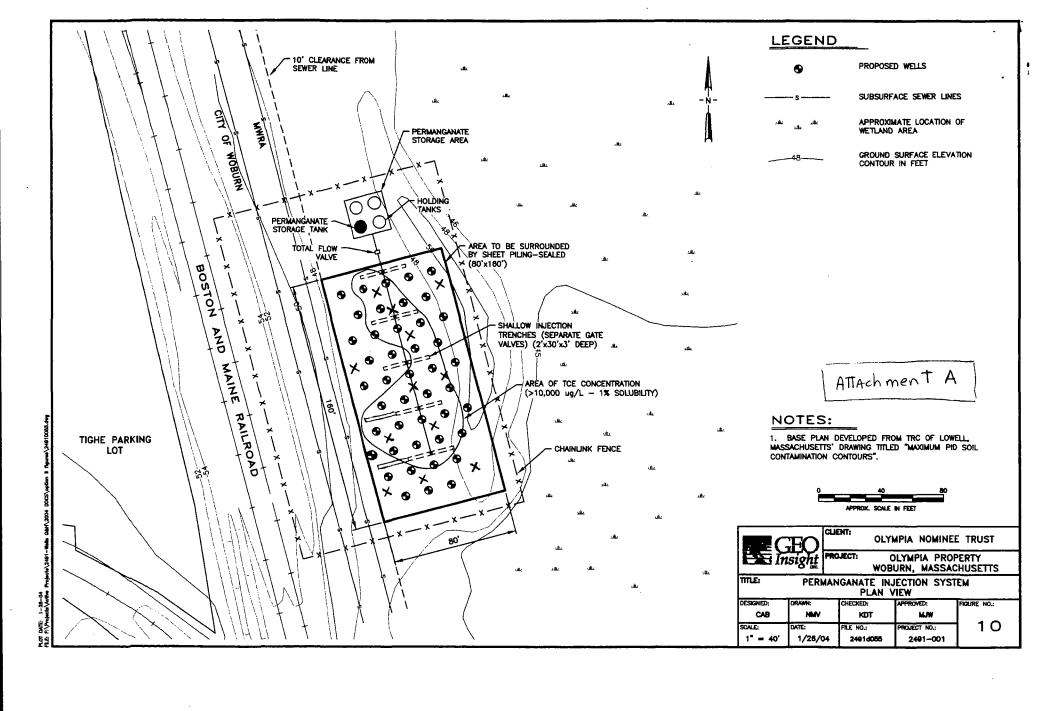
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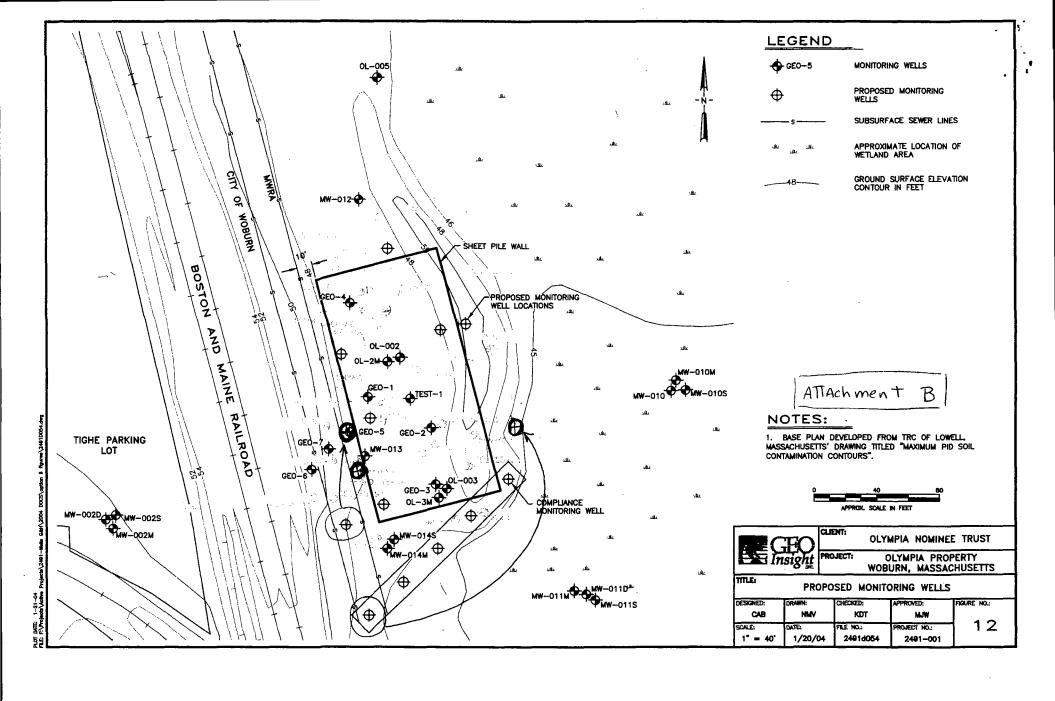
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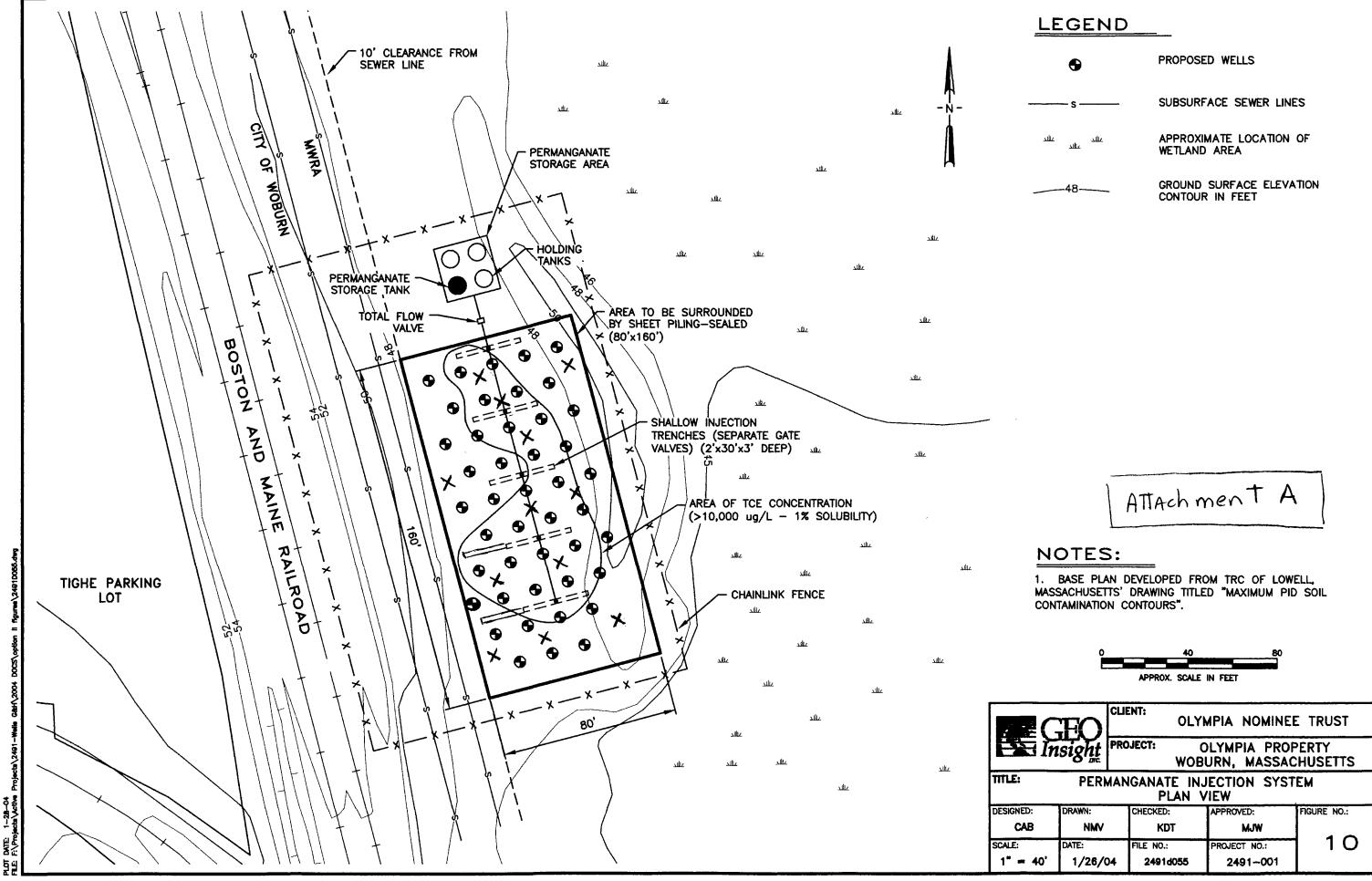
cc: Sharon Fennelly, Enforcement Coordinator

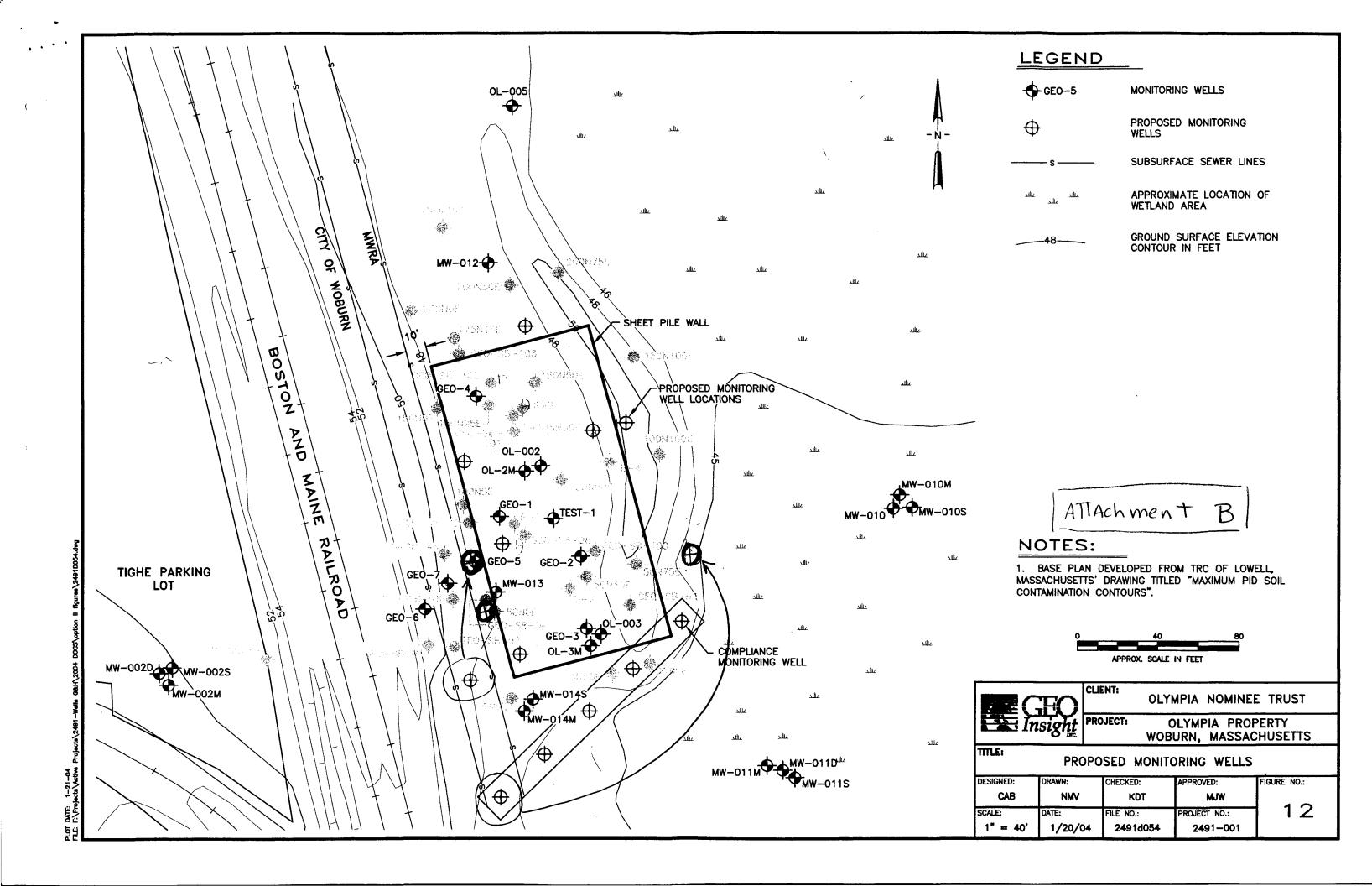
Joseph LeMay, Remedial Project Manager

Gretchen Muench, Case Attorney













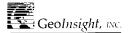
REVISED TCE WORK PLAN

REMOVAL ACTION 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

Prepared For:

Frank Gardner, On-Scene Coordinator
U.S. Environmental Protection Agency,
Region I
One Congress Street, Suite 1100
Mail Code HBR
Boston, Massachusetts 02114-2023

January 28, 2004



REVISED TCE WORK PLAN

REMOVAL ACTION 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

Prepared for:

Frank Gardner, On-Scene Coordinator
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January 28, 2004

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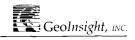


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Thorstensen Laboratory, Inc., April 24, 2003 Groundwater Analytical Inc., April 23, 2003 Groundwater Analytical Inc., June 25, 2003

APPENDIX E Laboratory Reports: Soil and Ground Water Sampling

Groundwater Analytical Inc., April 30, 2003 Groundwater Analytical Inc., June 3, 2003 Groundwater Analytical Inc., June 16, 2003

APPENDIX F Laboratory Reports: Grain Size:

GeoTesting Express Inc., May 15, 2003 GeoTesting Express Inc., July 16, 2003

APPENDIX G Laboratory Permanganate Demand Results:

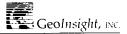
Groundwater Analytical Inc., June 19, 2003 Groundwater Analytical Inc., July 18, 2003

APPENDIX H Estimates of VOC Mass

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REVISED WORK PLAN

REMOVAL ACTION 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

1.0 INTRODUCTION

This Revised Work Plan was prepared in accordance with the Statement of Work (SOW) presented in Appendix D of the March 17, 2003 United State Environmental Protection Agency (USEPA) Administrative Order on Consent for Removal Action (CERCLA Docket No. 01-2003-0023; the "Order") for the Olympia Nominee Trust Property. This Work Plan was prepared by GeoInsight Inc. (GeoInsight) to address the presence of trichloroethene (TCE) in a relatively localized area of the Olympia Property that the United States Environmental Protection Agency (USEPA) has referred to as the former drum disposal area (FDDA).

GeoInsight submitted a draft Work Plan to the USEPA on August 7, 2003. Comments on the Work Plan were provided to GeoInsight on October 22, 2003. This Revised Work Plan includes additional information including design plans, schedules, detailed cost estimates and a monitoring plan. In response to USEPA's comments, GeoInsight expanded and amended several sections of this Revised Work Plan. One primary modification to the draft Work Plan was expanding the Conceptual Site Model (CSM) to include a discussion of dense non-aqueous phase liquid (DNAPL) ganglia in the silt unit. The revised CSM is presented in Section 3.0.

For this report, "Olympia Property" will refer to the FDDA and the associated small upland area located between the elevated Boston and Maine railway easement to the west and the western border of the Aberjona River wetlands to the east. The Olympia Property occupies the southwest portion of an approximately 20-acre parcel that is identified by the City of Woburn Assessor's Office as 60 Olympia Avenue. The area in the vicinity of the FDDA is the portion of the 60 Olympia Avenue property that was impacted by conditions associated with the former abandoned drums and the portion of the property that has been the focus of Superfund removal action response actions completed to date.



Figure 1 illustrates the location of the 60 Olympia Avenue property with respect to the regional features in Woburn and north Woburn. Figure 2 illustrates the general area included in the Wells G & H Superfund Site. Figure 3 provides a generalized plan of the 60 Olympia Avenue property and the approximate location of the FDDA.

1.1 PROPOSED WORK PLAN APPROACH

Response actions required in the Order included additional characterization of environmental conditions in the FDDA associated with TCE-impacted soil, evaluation of potentially applicable remedial technologies, recommendations for remedial actions to address the TCE-impacted soil on the Olympia Property, and an evaluation of soil clean-up standards. These requirements were in part, based upon a review of the results of soil sampling activities and analyses completed in 2002 that suggested elevated concentrations of TCE were present in saturated zone soils within the FDDA.

As described further in this Revised Work Plan, evaluation of historical information and the results of field investigation activities completed in accordance with the SOW associated with the Order indicated that concentrations of TCE present in ground water were detected up to 60% of TCE solubility. Although separate phase solvent was not observed during historical field investigation activities, elevated concentrations of TCE detected in discrete ground water samples indicated that DNAPL ganglia were locally present within the silt unit in the FDDA. Because the overall remedial objective for the FDDA (and the Wells G&H Superfund Site) is to reduce concentrations of VOCs in ground water below drinking water standards, GeoInsight proposes that the remedial endpoint for actions within the FDDA be based upon attaining the ground water cleanup level. Because of the conditions within the impacted area of the FDDA, it is difficult to predict with certainty the level of residual impacts that could remain in soil and yet be protective of ground water conditions (i.e., it is expected that a residual soil concentrations within the FDDA will need to be very low (similar to the cleanup levels included in the ROD) in order to achieve the required clean up goals for ground water). Consequently, the effectiveness



of remedial activities within the FDDA will be monitored and evaluated based upon measuring ground water quality conditions and achieving ground water remedial objectives.

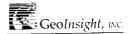
The results investigation activities indicated that the majority of TCE within the FDDA is located at a depth between 6 to 18 feet in a shallow silt unit. Consequently, this Revised Work Plan focused upon evaluating clean up technologies to address TCE-impacted soil and ground water present within the shallow silt unit within the FDDA.

1.2 SITE DESCRIPTION

The 60 Olympia Avenue property consists of 20.41 acres of land located on the south side of Olympia Avenue in Woburn, Massachusetts (Figure 3). The Property is separated into two parcels by the Aberjona River, which trends north-south through the general vicinity. The eastern parcel consists of a 6.59-acre rectangular lot that is occupied by a one-story building and paved parking areas. The western parcel consists of 13.52 acres of undeveloped woodlands and wetlands associated with the Aberjona River valley and adjacent floodplain. The east parcel is accessed from Olympia Avenue. The western parcel is not readily accessed by existing roadways.

The east parcel was first developed in 1963 as a trucking terminal. The building that currently occupies this portion of the parcel is currently occupied by several commercial businesses.

The western parcel consists of undeveloped woodlands and wetlands. The west border of the parcel is occupied by two subsurface sewer lines maintained by Massachusetts Water Resource Authority (MWRA) and the City of Woburn. The sewer lines are bounded to the west by a Boston and Maine railway easement. This portion of the property is accessed via a dirt path that extends northward from Salem Street and ends near the southwest corner of the western parcel. The dirt road crosses private property owned by William Holland (along Salem Street) and the Wildwood Conservation Trust. The general configuration of the 60 Olympia Avenue property is illustrated on Figure 3.



1.3 RELEASE DESCRIPTION

In 1979 and 1980, representatives of the Massachusetts Department of Environmental Protection (MADEP; then the Department of Environmental Quality Engineering) investigated the presence of a "pile of approximately a dozen 55-gallon drums" near the southwest corner of the Olympia Property (Figure 3). Some of the drums reportedly contained a solid, grease-like material while others were reportedly empty. In April 1985, the containers were re-discovered by USEPA and a limited sampling program was performed in September 1985. During the sampling program, USEPA documented the presence of 12 drums that were in various states of deterioration. Elevated concentrations of chlorinated volatile organic compounds (VOCs), primarily TCE and tetrachloroethene (PCE), were detected in soil samples collected near the drums.

During February 1986, Olympia Nominee Trust conducted a Private Responsible Party Cleanup at the drum location. The drum location was accessed via a temporary bridge that was constructed over the Aberjona River. Olympia Nominee Trust hired Clean Harbors, Inc. (CHI) to remove, secure, and dispose of the drums and drum contents that were observed on the ground surface. Three empty rusted 55-gallon drums and nineteen 55-gallon drums of excavated soil were removed from the property. Excavation activities reportedly resulted in the upper 12 to 18 inches of soil being removed from the general area of the drums. The drums were temporarily stored in a staging area on the paved parking lot to the northwest of the site building prior to transportation off-site for disposal. Based upon the results of characterization analyses, CHI transported the drums to the Chem-Waste Management facility in Emelle, Alabama.

The exact locations of the former drum disposal areas are not well defined. Twelve drums were removed by the USEPA in 1985 and three rusted drums were removed by CHI in 1986. These cleanup areas may correlate to two potential release areas. However, the commingling and dispersement of impacts in the subsurface is being treated as one primary cleanup area in this Revised Work Plan.

Based upon conditions associated with the abandoned drums and impacts to local soil and ground water, the Olympia Property was identified as one of five possible source areas for



ground water impacts associated with City of Woburn municipal water supply wells G and H (and the associated Wells G & H Superfund Site).



2.0 SUBSURFACE INVESTIGATIONS

2.1 SUMMARY OF PREVIOUS FINDINGS

This section of the Work Plan provides a brief summary of previous environmental investigations performed at the Olympia Property. Most of the historical field investigation activities were completed during the remedial investigation completed for the Wells G & H Superfund Site. As such, activities were generally completed at the Olympia Property as part of the larger regional evaluation program that included the Aberjona River Valley. As discrete source areas were identified, field investigation activities became more focused. The results of the historical investigation activities were used to develop a conceptual site model that formed the basis for subsequent remedial action evaluations.

Remedial investigation activities included multiple phases of field activities performed over several years, including the advancement of soil borings and installation of ground water monitoring wells throughout the Olympia Property (Figure 4). Soil borings and monitoring wells within the area of the FDDA prior to 2000 included; "OL" wells (1987, EBASCO), soil borings at the nodes of a surveyed grid (1997, Brown and Root Environmental), deep "B" ground water borings (1998, GeoInsight), and deep "GEO-1 and GEO-2" soil borings/wells (1999, GeoInsight). TRC completed 21 soil borings identified by grid node coordinates (0N0E to 200N75E, and TL-north and TL-south). Current assessment activities performed by GeoInsight and described in this report included boring locations GEO-SB-90 through GEO-SB-103 and monitoring wells GEO-3 through GEO-7 (April to June 2003).

The results of historical VOC analyses for ground water and soil (1987 through 2003) for the FDDA are compiled in Tables 1 and 2, respectively, and are based primarily upon the findings of the following characterization activities.

2.1.1 Remedial Investigation - USEPA

In the mid to late 1980s, the USEPA coordinated the investigation of impacted ground water



detected in the City of Woburn municipal drinking water supply wells G & H. Based upon these investigation activities, the USEPA identified a wide area in the general vicinity of the wells that was characterized by the presence of VOCs in soil and ground water at elevated concentrations. This area, bounded to the north by Route 128, to the east by Washington Street, to the south by Salem Street, and to the west by the Boston and Maine railway easement, was identified as the Wells G & H Superfund Site (Figure 2).

Remedial investigation activities coordinated by the USEPA identified five source areas, including the W.R. Grace and Unifirst properties located near the intersection of Olympia and Washington Streets, the New England Plastics property to the west of the intersection of Washington and Salem Streets, the Beatrice/Wildwood Conservation Trust property to the north of the intersection of Salem Street and the Boston and Maine railway easement, and the Olympia Nominee Trust property located near the north end of the railway easement.

These activities included the installation (in 1987) of three shallow (8.5 to 9 feet deep) ground water monitoring wells (designated OL-002, OL-003, and OL-005) on the Olympia Property. The remedial investigation included a ground water sampling event performed in 1987. VOCs were not detected in the ground water sample collected from well OL-005. Elevated concentrations (i.e., tens to thousands of ug/l) of VOCs were detected in the ground water samples collected from wells OL-002 and OL-003. The VOCs detected at the highest concentrations in the ground water samples included PCE (45 ug/l) and TCE (3,400 ug/l; Table 1A).

In addition to the three shallow wells, four monitoring well nests were installed within the general vicinity of the Olympia Property. Each well nest consisted of three overburden monitoring wells (shallow, medium, and deep). Two of the well nests were located to the west of the railway easement (S-76, approximately 500 feet northwest of the FDDA, and S-79, approximately 500 feet southwest of the FDDA). One of the well nests was located in the wetland area associated with the Aberjona River (S-88, approximately 400 feet southeast of the FDDA), and one of the wells was located on the east side of the Aberjona River (S-72, approximately 500 feet northeast of the FDDA; Figure 2).



Although these wells were not located on the Olympia Property, they did provide stratigraphic, hydraulic, and ground water quality information for the general area. However, these wells were generally located outside of the extent of ground water impacts associated with the Olympia Property.

2.1.2 United States Geological Survey - 1987

In 1987, the United States Geological Survey (USGS) completed a hydrogeologic investigation of the central Aberjona River valley. The focus of the investigation was to evaluate the area of influence and zone of contribution to City of Woburn municipal wells G and H. In general, the investigation included compiling existing hydrogeologic data for the Superfund Site area, installing new observation wells, performing seismic surveys, collecting surface water and ground water hydraulic information, and performing aquifer pump tests.

The USGS developed a generalized stratigraphy for the central river valley that included four stratigraphic layers with the upper three layers considered to be the local aquifer.

- the uppermost stratigraphic layer consists of sand, silt, clay, and peat deposits, and has a thickness ranging up to 30 feet. The FDDA would fall into this unit classification;
- the uppermost unit is underlain by an intermediate layer of fine to coarse sand that has a thickness of 10 to 50 feet;
- the lowermost stratigraphic unit (the primary aquifer layer), in which Wells G & H were screened, consists of coarse sand and gravel that has a thickness of 20 to 50 feet;
- a layer of fine grained sand and silt occupies the deepest portions of the river valley and is situated directly on top of bedrock.

Hydraulic information obtained by the USGS indicated that the general direction of ground water flow in the Aberjona River Valley was inward toward the river and to the south. Data obtained under non-pumping conditions indicated that the direction of ground water flow in the FDDA



was to the south and southeast.

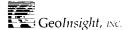
2.1.3 GeoTrans, Inc. - February 1994

In February 1994, GeoTrans, Inc. (GeoTrans) completed a remedial investigation of the central area of the Wells G & H site. The investigation included compiling information from the five source area properties and from the central river valley. Additional field investigation activities were performed at potential source area properties, including to the north of Olympia Avenue, and to the south along Salem Street.

The additional data obtained in the central river valley since the USGS completed their study generally confirmed the USGS's conceptual hydrogeologic model. During the investigation, GeoTrans summarized historical stratigraphic and ground water quality data, and performed additional field investigation activities in portions of the Wells G and H site where data gaps were present. GeoTrans also performed focused ground water sampling events, although these events did not include wells located on the Olympia Property.

2.1.4 Brown & Root Environmental - September 1997

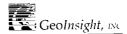
During September 1997, Brown and Root Environmental (BRE), on behalf of USEPA, performed a soil sampling event at the 60 Olympia Avenue property. This was the first focused investigation conducted at the FDDA. BRE developed a sampling grid (48 nodes) that was approximately 125 feet wide and 280 feet long in the portion of the 60 Olympia Avenue property where the drums were formerly located. Samples of surface soil from each node were screened in the field using a flame ionization detector (FID) and photoionization detector (PID). Eight surface soil samples were collected from nodes where elevated field screening results were obtained. These samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), Total Analyte List (TAL) metals, total organic carbon (TOC), and particle size distribution.



With the exception of low concentrations of methylene chloride and acetone, VOCs were not detected in the eight soil samples. Because methylene chloride and acetone were detected in the trip and laboratory blanks, detection of these compounds was attributed to laboratory contamination. Low concentrations (tens to several hundreds of parts per billion) of several SVOCs were detected in the soil samples. The types of SVOCs detected were predominantly polynuclear aromatic hydrocarbons (PAHs), including phenanthrene, pyrene, fluoranthene, and benzo(k)fluoranthene. PCBs were not detected in the eight soil samples. Pesticides were detected in the soil samples at generally low concentrations ranging from <1.0 to 13 ug/kg (ppb). The concentrations of metals detected in the soil samples were consistent with general background ranges for soils in New England. Based upon the results of the surficial soil analyses, subsurface soil samples (0 to 4 feet BGS) were collected from five of the nodes and analyzed for the same suite of parameters as the surficial soil samples.

The presence of low concentrations of PAHs and pesticides is likely related to general impacts associated with a heavily developed urban setting, including the nearby railroad easement and tracks. The types of PAHs detected in the soil samples are common constituents of petroleum and coal emissions. Coal slag has been observed along the railway easement and in the top layer of soil on the Olympia Property.

In September 1997, BRE also performed a ground water monitoring event that included collecting 39 ground water samples from 24 monitoring wells located in the Aberjona Central River Valley (including wells OL-002 and OL-003). In general, the results are similar to the results of analyses performed in December 1987 (the only other sampling event where OL-series wells were sampled). Data from OL-002 (the shallow well located where the drums were removed and soil excavated) suggested little change in ground water quality (the same three compounds were detected at similar concentrations; Table 1A). Although similar compounds were detected in the samples from well OL-003, the relative concentration distribution of the VOCs during the 1997 event compared to the 1987 event suggested that natural degradation of the chlorinated hydrocarbons was occurring. In the 1987 event, parent compound (PCE and TCE) concentrations were highest. In the 1997 event, daughter compound (1,2-DCE and vinyl chloride) concentrations had increased and parent compound concentrations had decreased (table 1A).



BRE performed constant rate, single well pump tests in wells S-72S, S-76M, and OL-002. The hydraulic conductivity of aquifer materials at each of these locations was estimated to be 47.7 ft/day for well OL-002, 3.1 ft/day for well S-72S, and 18.9 ft/day for well S-76M.

2.1.5 GeoInsight, Inc. - February 1998

In February 1998, GeoInsight performed a focused microboring investigation at the Olympia Property. The focus of the investigation was to qualitatively evaluate the vertical distribution of dissolved-phase VOCs in the FDDA. The investigation included the advancement of two shallow and two deep microborings. The deep microborings were advanced manually by Pine & Swallow Associates using a 1/2-inch diameter steel microwell that contained a 24-inch long screened section. The shallow microwell consisted of 1/2-inch diameter steel microwell that contained a 5-foot long screened section. At the time the borings were advanced, field observations indicated that the depth to ground water in the FDDA was approximately one to two feet below the ground surface (BGS).

In the deep borings, ground water samples were collected from the microwells at seven-foot intervals to a maximum depth of 72 feet BGS. Boring B-1 was installed in the area where the drums were removed and soil was excavated. B-2 was installed approximately 50 feet southeast of B-1, in a direction estimated to be hydraulically down gradient of the FDDA. In the shallow borings (B-3 and B-4), ground water samples were collected from a depth of three to eight feet BGS. The water samples were collected using watera sampling equipment and were not field filtered to remove sediment. The samples were submitted to Alpha Analytical Laboratories and analyzed for chlorinated hydrocarbons by USEPA Method 8010. Laboratory results are summarized on Table 1B. These boring locations are shown on Figure 4.

Ground water concentrations were highest in the sampling intervals from 7 to 9 feet BGS (150,000 ug/l to 160,000 ug/l) and 16-18 feet (2,600 ug/l to 3,300 ug/l) in these borings. Below 18 feet the concentration of TCE decreased significantly with depth (Table 1B).



2.1.6 GeoInsight, Inc. - Fall 1999

In the fall of 1999, GeoInsight performed a focused field investigation to evaluate the quality of deep overburden ground water in the vicinity of the FDDA. The primary objective of the investigation was to evaluate the possible presence of deep DNAPL (i.e., DNAPL pooled on the bedrock surface) in the vicinity of the FDDA. The investigation was performed in accordance with GeoInsight's July 1, 1999 Scope of Work for Well Installation and Ground Water Sampling Program, which was revised on July 22, 1999 based upon comments received from the USEPA.

During the last week of August and first week of September 1999, GeoInsight coordinated the advancement of two deep soil borings and the installation of two deep overburden monitoring wells. One well (GEO-1) was installed where the drum removal and soil excavation activities were performed, and the second well (GEO-2) was installed between the former drum location and the wetlands to the east (in a location estimated to be hydraulically downgradient of the former drum location). In each boring, split-spoon soil samples were collected continuously to a depth of 20 feet BGS, and at 5-foot intervals thereafter. Apparent bedrock (as evidenced by split-spoon and roller-bit refusal) was encountered at depths of 102 feet (GEO-1) and 107 feet (GEO-2) BGS. The locations of GEO-1 and GEO-2 are shown in Figure 4.

Split-spoon soils samples were screened in the field for total VOCs. Based upon the results of the field headspace screening and visual characterization, one soil sample was selected from each boring for analysis of VOCs. In addition, select soil samples from each boring were analyzed for TOC and grain size. Results are presented in Table 8.

Standard 2-inch diameter polyvinyl chloride (PVC) monitoring wells were constructed in each boring. Each well was constructed with a 10-foot long section of well screen. GEO-1 was set at a depth of 100 feet BGS and GEO-2 at a depth of 105 feet BGS. Upon completion, the wells were developed.



Ground water samples were collected on September 21, 1999 from wells GEO-1 and GEO-2 and analyzed for VOCs by USEPA Method 8260B. Low concentrations of TCE (1.6 to 2.5 ug/l), toluene (1.6 ug/l), and methylene chloride (8.8 to 12 ug/l) were detected in the ground water samples (Table 1A).

Information obtained during the subsurface investigation, including the results of headspace soil screening and ground water sample analyses, indicated that impacts by VOCs were present primarily in the upper portion of the overburden (within the first 15 to 25 feet BGS) and that these data did not indicate the presence of separate phase solvent or DNAPL near the bedrock surface.

2.1.7 TRC Environmental – December 2002

Site characterization activities were completed at the Olympia Property during 2002 by USEPA's contractor TRC Environmental Corporation (TRC). The results of TRC's activities were summarized in a December 2002 "Data Summary Report for the FDDA." TRC advanced soil borings and collected PID field screening data (with depth) to delineate the horizontal and vertical extent of VOCs in soil and ground water. Soil samples exhibiting the highest PID reading were submitted for laboratory analyses (the results of these analyses are included in Table 2). TRC also collected ground water samples from existing wells (these data are included in Table 1A). Maps and cross-sections prepared by TRC that summarize the results of these investigation activities are included in Appendix A.

Based upon the field screening results, TRC identified two areas that were characterized by elevated VOC concentrations: 1) the area north of well OL-002 (Zone A), and 2) the area in the vicinity of newly installed well MW-013 (Zone B, near the sewer lines). Refer to TRC's Figure 2 (Appendix A) for the general locations of these zones.

The results of field headspace screening and laboratory analyses of ground water samples indicated that the distribution of VOCs was confined to the silt unit. The highest TCE

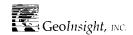


concentrations (greater than 1,000 ug/l) were detected in the vicinity of wells OL-002, TEST-1 and MW-013. Other VOCs, including PCE, cis-1,2 DCE, vinyl chloride (VC), ethylbenzene, and xylenes, were detected at much lower concentrations, generally ranging from single digit to hundreds of ug/l.

2.1.8 TRC Environmental - April 2003

In August 2002, TRC conducted short-duration ground water pumping tests in three FDDA wells, including OL-003, MW-013, and Test-1. The results of the pump test were summarized in TRC's April 2003 "Multi-Well Aquifer Test Report." Hydraulic conductivity values calculated using hydraulic measurements obtained during the tests ranged from 0.34 feet per day (ft/day) in well Test-1 to 129 ft/day in well OL-3. These wells are shallow wells that are screened across the sand-silt boundary. The hydraulic conductivity value calculated using hydraulic measurements obtained during the pump test in well MW-13 was 2.7 ft/day. Based upon the results of the short-duration pump tests, TRC concluded that the low hydraulic conductivity of the silt unit, and the apparent heterogeneous nature of the aquifer would have significant impact on the design and implementation of a remedial technology for the Olympia Property.

It is important to note that the hydraulic conductivity estimates obtained by TRC during the short-term pump tests should be regarded as approximate because of the limitations associated with performance of the pump tests. Extraction rates during the pump tests were low, the duration of each pump test was short, and ground water drawdown was not observed in surrounding monitoring wells. Due to the low sustainable flow rates associated with the selected pumping wells and the absence of measurable drawdown in the nearby monitoring wells, TRC estimated hydraulic conductivity using drawdown measurements obtained from the pumping. If the pumping well is not 100% efficient, the drawdown measured in the test well will be lower than the drawdown in the aquifer immediately outside the test well. In this situation, the drawdown in the test well may not be representative of aquifer conditions, and therefore the estimated hydraulic conductivity values would not be representative of the aquifer hydraulic conductivity. In addition, two of the pumping wells are screened across multiple soil units.



Consequently hydraulic data obtained from these wells can not be associated with an individual soil unit.

2.2 GEOINSIGHT 2003 INVESTIGATION

Between April and July 2003, GeoInsight conducted investigation activities in the FDDA to collect additional data regarding soil and ground water conditions and to evaluate possible remedial options. Data obtained by TRC suggested that areas of VOC-impacted soil were present to the north of well OL-002 and near well MW-013 (the southwest portion of the FDDA area near the sewer lines). To further evaluate conditions in the FDDA, GeoInsight performed the following activities:

- collected soil and ground water samples from the vicinity of the sewer lines;
- collected soil and ground water samples from specific subsurface strata to evaluate sorption potential, organic carbon content, and mass of VOCs adsorbed to soil;
- collected soil samples to estimate permanganate demand; and
- installed small-diameter wells to collect ground water samples for investigating the horizontal and vertical extent of ground water impacts.

2.2.1 Sewer Line Investigation

Data obtained by TRC suggested that subsurface impacts extended to the west toward the sewer lines. In Zone B, the highest headspace screening results appeared to be obtained directly adjacent to the sewer line, and the concentrations were greatest at the approximately depth of the base of the sewer line. These data suggested that some of the field results obtained by TRC could be attributable to conditions or impacts near or associated with the sewer line (note; the City sewer line is constructed of vitrified clay pipe; the MWRA sewer line is constructed of concrete pipe). Based upon plans provided by the MWRA, the approximate depth to the Woburn



sewer line was 8 to 10 feet BGS, and the depth to the MWRA sewer line is 10 to 13 feet BGS. GeoInsight conducted assessment work in the interval adjacent to the sewer line to depths of 12 and 16 feet to evaluate if the sewer line or sewer line bedding was a source of impacts.

On April 22, 2003, GeoInsight sampled three wells (MW-013, MW-014S, and OL-002) to evaluate whether constituents typically associated with waste-water were present in ground water near the sewer lines. Because monitoring well OL-002 is not located directly adjacent to the sewer lines, data from this well were considered representative of non-impacted conditions (with respect to possibly leaky sewer lines). Ground water samples were analyzed for fecal coliform, chloride, fluoride, ammonia, and nitrate. Results are summarized in Table 3. Fecal coliform and fluoride (constituents often detected in waste water) were not detected in the samples. The concentrations of chloride, ammonia, and nitrate in MW-013 and MW-014S did not appear elevated compared to estimated background conditions for the area (OL-002).

On June 12, 2003, GeoInsight advanced nine soil borings, (GEO-SB-90 through GEO-SB-97, and GEO-7) in the vicinity of the City of Woburn and MWRA sewer lines. Three of the borings (GEO-SB-90, GEO-SB-93, and GEO-7) were completed as shallow monitoring wells GEO-5, GEO-6, and GEO-7, respectively. Figure 4 illustrates these boring and well locations. The wells were constructed using 1-inch diameter PVC materials, with 5 feet (GEO-6) and 10 feet (GEO-5 and GEO-7) of slotted screen and 11 feet and 6 feet, respectively, of PVC riser.

During advancement of soil borings, soil was screened for the presence of VOCs with a PID using the headspace method. PID screening was conducted by filling a headspace jar half full with a soil sample, covering the jar with foil, capping the jar and allowing for headspace equilibration at ambient temperatures for 10 to 15 minutes. The PID was calibrated at the start of each day, and the PID response was checked periodically using a volatile pen. PID readings are summarized on Table 4. PID measurements ranged from non-detect to 8.7 parts per million (ppm).

Soils encountered in the borings in the vicinity of the sewer line consisted of fine sand and silt. Coarser sands and fine gravels were observed in several borings (GEO-SB-90, GEO-SB-91,



GEO-SB-95, GEO-SB-96, GEO-7) at depths between 8 and 10 feet BGS. The observation of gravels at depth in this area may be associated with an underdrain or sewer line bedding. However, fine gravel layers were also observed at shallower depths in this area. Elevated PID readings were not measured in soil samples obtained from the interval adjacent to the sewer line or sewer line bedding.

On June 24, 2003, wells GEO-5, GEO-6, and GEO-7 were sampled by low flow techniques. The wells were purged with a peristaltic pump and dedicated polyethylene tubing. The ground water parameters dissolved oxygen (DO), oxygen reduction potential (ORP), pH, and conductivity were monitored until stabilization and a ground water sample was collected. Field parameter data are summarized in Table 5. Ground water samples were submitted to Groundwater Analytical (GWA) laboratory for analysis of VOCs by EPA method 8260B. Results are summarized in Table 1.

Elevated concentrations of PCE and TCE (280 ug/l and 3,300 ug/l, respectively) were detected in the ground water sample from well GEO-5, located east of the MWRA sewer line and upgradient of well MW-013. Low concentrations of PCE and TCE (2 and 8 ug/l, respectively) were detected in the ground water sample from well GEO-7, located between the two sewer lines. VOCs were not detected in the ground water sample from well GEO-6, located west of the City of Woburn sewer line.

The results of the focused investigation activities did not suggest that during April 2003 ground water in the FDDA were impacted by significant leakage from the nearby sewer lines or the migration of impacted ground water along sewer line bedding materials. In addition, data obtained during June 2003 from the general vicinity of the sewer easements indicated that ground water impacts did not appear to extend to the originate on the west side of the sewer easement. During pre-design, additional focused soil borings will be advanced and monitoring wells installed to the west of the sewer line to further evaluate the possible migration of impacted water to the west of well MW-013, including at depths deeper than completed during this focused investigation.

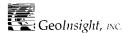


2.2.2 Soil and Ground Water Investigation Activities

On April 25 and 28, 2003, GeoInsight completed a focused geoprobe investigation of the FDDA. The objective of the focused geoprobe investigation activities was to obtain data to develop site-specific sorption coefficients for the VOCs present within the FDDA (primarily TCE) and evaluate VOC distribution in different stratigraphic layers. Geoprobe investigation activities included the advancement of six geoprobe borings (designated GEO-SB-98 through GEO-SB-103). During boring advancement, direct push soil samples were collected for field PID screening and certain samples were selected for laboratory analyses of VOCs, total organic carbon (TOC), and grain size analyses.

Ground water samples were collected from separate borings that were advanced directly adjacent (within 1 foot) to the borings where depth-discrete soil samples were collected. The ground water samples were collected using a discrete water sampler that was driven to the selected sampling depth. Ground water was purged using a watera valve prior to sampling. Boring logs and photographs obtained during the geoprobe investigation are included in Appendices B and C, respectively. The locations of the geoprobe borings are illustrated on Figure 4.

PID field screening measurements of the soil samples collected during the geoprobe investigation ranged from non detect to 690 ppm (GEO-SB-101 18 feet BGS). PID measurements are summarized in Table 4 and presented in cross section on Figures 5 and 6. Figure 5 includes PID measurements obtained by TRC and GeoInsight's recent PID results along cross section A-A' and Figure 6 includes similar information along cross section B-B' (the locations of these cross sections are indicated on Figure 4). Figure 5 indicates that elevated PID measurements were obtained northwest of OL-002 in the vicinity of GEO-SB-102 and GEO-4, consistent with TRC's findings. Figure 6 indicates that elevated PID measurements were detected near well GEO-5. In general, the maximum PID readings of soil samples collected during GeoInsight's investigation were an order of magnitude lower than the maximum PID readings of soil samples collected by TRC. Based upon a review of the available PID headspace screening and ground water quality data, it appears that the greatest subsurface impacts are located in a general zone that extends from TRC-designated Zone A to Zone B. The proposed



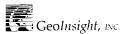
remedial approach will address impacts located within both of the TRC-designated "zones." Therefore, additional investigation activities will not be completed to further evaluate or define Zone A and B (i.e., for remedial objectives, it is not critical to make a distinction between these two zones).

The concentration of TCE measured in the soil samples ranged from not detected to 120 milligrams per kilogram (mg/kg) at a depth of 14.5 feet BGS in boring GEO-SB-102. GEO-SB-102 was collected in the area of highest PID readings recorded by TRC and GeoInsight. The concentration of TCE in ground water samples ranged from not detect to 670,000 ug/l in boring GEO-SB-102 (13 to 14.5 feet BGS). TOC concentrations ranged from not detected to 2,200 mg/kg in the silt layer (GEO-SB-98 at 6 feet BGS). The results of TOC analyses indicated that in the FDDA shallow soils are characterized by very low TOC content (less than one-tenth of a percent). A summary of the analytical results is provided in Table 7.

Seven soil samples from three of the boring locations were submitted for grain size analysis using dry sieve methods for sandy soil and sieve and hydrometer methods for silty soils. The results of the grain size analyses (Table 8) indicated that the surficial sandy soil to a depth of approximately six to eight feet BGS was composed primarily of medium sand (GEO-SB-104, 4 feet BGS). The underlying fine-grained layer, which has been characterized as a "silty clay" or "clayey silt" in field descriptions, appeared to be composed primarily of silt, with the percentage of silt ranging from approximately 76% to 89% by weight. Clay-size particle percentages were low, ranging from 5% to 13 % by weight. Grain size data are included in Appendix F.

2.2.3 Soil Permanganate Demand Testing

To evaluate the effectiveness of chemical oxidation as a remedial option, soil samples from the FDDA were analyzed for permanganate demand. The permanganate demand test provided an estimate of how much oxidant will be required to satisfy the oxidation demand present in the soil, which is associated with organic matter and reduced mineral species that can become oxidized, and organic material (including VOCs) present on the soil and in ground water.



Soil samples were collected from eight borehole locations at depths ranging from 4 to 19 feet BGS. Eleven soil samples were submitted for laboratory permanganate testing. The soil samples selected for the permanganate testing included material obtained from the surficial sand and underlying silt units, and samples of organic/peaty soil obtained from borings advanced near the eastern border of the FDDA (i.e., near the western edge of the Aberjona wetland area). Field locations selected for the study included two upgradient/cross-gradient borings (GEO-SB-103 and GEO-SB-91), one downgradient boring (GEO-SB-99), and five borings located within TCE-impacted areas (GEO-SB-98, GEO-SB-100, GEO-SB-101, GEO-SB-102, GEO-5). Boring locations are shown on Figure 4. Results of the permanganate demand testing are summarized in Table 9 and discussed in Section 5.5.1.

2.2.4 Micro Well Installation

On June 12, 2003, GeoInsight installed two monitoring wells to evaluate ground water conditions within the silt unit at the most impacted area (as identified by TRC) within the FDDA (well GEO-4) and near the downgradient (i.e., southeast) portion of the FDDA (GEO-3). These wells were installed by direct push methods using a geoprobe rig. The wells were screened from 6 to 16 feet BGS. The well locations are shown on Figure 4. Soil boring logs are attached in Appendix B. Ground water samples were collected on June 24, 2003. Ground water concentrations ranged from 4 ug/l to 340 ug/l in these wells. Results are presented on Table 1A.

2.2.5 DNAPL Evaluation

Dissolved TCE detected in ground water samples from monitoring wells within the FDDA are generally less than 1% of TCE solubility and therefore do not suggest the presence of large-scale DNAPL. DNAPL was not observed during field investigation and sampling activities completed within the FDDA. However, ground water concentrations in geoprobe discrete ground water samples (1 to 2 foot sampling intervals) that were significantly higher (100,000 ug/l range) than ground water collected from nearby monitoring wells suggest that separate phase solvent is



likely present near these sampling points. These data suggest that DNAPL is likely present as discrete ganglia in the silt unit. Water samples collected from wells screened across the sand-silt interface at the FDDA are consistently lower than discrete samples, and may be "diluted" by the ground water in the overlying sand unit. Sampling discrete water samples provides valuable insight by providing a representative water sample collected in-situ.

Laboratory analyses of discrete in-situ pore water detected TCE at concentrations ranging up to 670,000 ug/l (approximately 60% of solubility). Seven out eight ground water samples collected by geoprobe discrete water sampling exceeded 1% TCE solubility and three samples exceed 10% TCE solubility. Ground water concentrations that exceed 1% and 10% of solubility are indicative of subsurface conditions that may be likely supersaturated with regard to TCE and may not be at equilibrium with surrounding soil matrices. Literature references often cite 1% to 10% of solubility as criteria that may indicate the presence of DNAPL ganglia near monitoring locations. Data obtained to date suggest that DNAPL ganglia are present within the silt unit within the central portion of the FDDA (an area extending from GEO-SB-102 in the north to B-2 in the south).

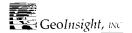


3.0 CONCEPTUAL SITE MODEL

This section of the Revised Work Plan provides a summary of the Conceptual Site Model (CSM) developed for the Olympia Property. The CSM is based upon the results of regional and site-specific historical investigation activities and is used to evaluate the potential effectiveness of various remedial technologies and alternatives. The CSM includes a description of the regional and local geologic and hydrogeologic setting, the magnitude, extent, and nature of soil and ground water impacts, and conditions within the FDDA as they relate to the designing and implementing remedial actions at the Olympia Property. The CSM section of the Work Plan was expanded to address comments provided by the USEPA.

Subsurface impacts in the FDDA are the result of a surface release of chlorinated solvents from former drum disposal in various locations at the FDDA. At the time of drum removal, a limited quantity of surface soil was removed and disposed off-site. The migration of solvent during early release time periods was likely controlled by gravity drainage and advective transport through the upper shallow sand layer. Longer term migration into the underlying silt unit was primarily through diffusion and transport through preferential pathways, including fractures and coarser-grained (i.e., more permeable) lenses.

As will be described more fully in the sections that follow, the FDDA consists of a shallow upper sandy unit that overlies a predominately silty unit. The silty unit was observed to be stratified consisting of layers of silty materials with occasional thin layers of coarser (sand lenses) and finer (clay lenses) materials. The release of solvent at the ground surface would be expected to vertically migrate through the shallow sandy vadose zone, through the sandy saturated unit to the underlying lower permeability unit. At the interface of the two units, vertical migration of the solvent would be slowed and some of the material would spread laterally along this interface. Irregularities in the surface could cause spreading in multiple directions. Additional vertical migration would occur within the silt unit and through localized preferential pathways. During transport through these soil units, the solvent likely became distributed as three primary phases; 1) solvent absorbed to or entrained within soil particles, 2) solvent trapped as DNAPL ganglia in pore spaces, and 3) solvent dissolved into ground water. Over time, the three phases of solvent



would be subjected to a range of attenuation mechanisms.

Based upon review of historical logs for soil borings completed within the FDDA, the upper sand - silt interface appears to slope slightly downward towards the north (Figure 5). The transition from the upper sand into the silt unit is less definitive in northern and western portions of the FDDA. In the southern portion of the FDDA, near GEO-SB-103, the boundary between the upper sand and silt is more pronounced. The silt unit appears more homogeneous in this area (southern portion of the FDDA). Because of the heterogeneous nature of the silt unit underlying the potential release area, the distribution of solvent (and DNAPL ganglia) appears to be influenced by the irregular surface of the sand silt boundary, and the presence of sand lenses and higher permeability layers.

3.1 STRATIGRAPHY

3.1.1 Aberjona River Valley - Regional

Conceptual hydrologic and stratigraphic models were previously developed (1987) by the USGS for the central Aberjona River Valley, including the Olympia Property. The USGS described a general stratigraphy for the central Aberjona River Valley, focused upon the areas near wells G & H and the associated wetlands/flood plain. This generalized stratigraphy included, from the ground surface downward:

- sand, silt, clay, and peat; 0 to 30 feet thick;
- fine to coarse sand; 10 to 50 feet thick;
- coarse sand and gravel; 20 to 50 feet thick; and
- fine grained sand and silt (over bedrock).

In the central portion of the river valley the depth to bedrock generally ranges from 80 to over 120 feet BGS. Locally, a peat deposit underlies most of the wetland areas that borders the river and forms a nearly continuous layer on top of the stratified drift. The thickness of the peat



generally ranges from two to seven feet. Based upon visual observations and test boring data from other locations within the wetland area, it is likely that peat deposits occur adjacent to the upland area that defines the east border of the Olympia Property.

According to the USGS conceptual model, ground water in the Aberjona River valley in the vicinity of Wells G & H is present mainly in a 0.5 to 1.0-mile wide stratified drift aquifer that fills a deep, narrow bedrock channel. Ground water in the stratified drift is unconfined, and water levels fluctuate continuously in response to recharge and discharge. The water table is generally at or near the ground surface in most of the low-lying areas. The direction of ground water flow is typically inward toward the central axis of the river. Under non-pumping conditions, the USGS indicated that ground water discharged to the river and adjacent wetlands. Appreciable vertical hydraulic gradients were generally only observed near the outer river valley walls or directly adjacent to the river channel. Ground water flow elsewhere was primarily horizontal.

3.1.2 Olympia Property - Former Drum Disposal Area (FDDA)

Based upon two deep soil borings advanced by GeoInsight (GEO-1 and GEO-2) in the vicinity of the FDDA, and subsequent borings completed by TRC in 2003, the following basic stratigraphic units were identified:

• 0 to 5 feet BGS; medium to coarse sand;

• 5 to 23.5 feet BGS: silt with varying amounts of fine sand and clay;

• 23.5 to 100 feet BGS: silt and fine sand;

• 100 to 105 feet BGS: medium sand (till).

The soils observed while installing the deep overburden monitoring wells were consistent with the general stratigraphy described for the Aberjona River valley during previous investigations, with the following exceptions and clarifications:



- During the installation of wells OL-002 and OL-003, gray clay was reportedly
 encountered at a depth of 9 feet BGS (these borings were advanced to a total depth of 11
 feet BGS). GeoInsight did not encounter a distinctive gray clay layer. However, thin
 (1/4-inch or less), gray clay seams were observed within the silt layer that were present
 from depths of 5 to 16 feet BGS in nearby borings (GEO-1).
- A thin seam of black-stained sand was observed at the interface (5 feet BGS) between the upper sand layer and the underlying silt in boring GEO-1. This soil sample exhibited the highest headspace screening result (1,729 ppm) in that boring. A sample of the soil that was submitted for laboratory analyses contained TCE (200 mg/kg), PCE (40 mg/kg), xylenes (23.9 mg/kg), and ethylbenzene (4.8 mg/kg).
- Similar to conditions in boring GEO-1, the soil sample obtained from the upper sand layer/silt interface in boring GEO-2 (at a depth of 6 feet) also exhibited the highest headspace screening result (371 ppm) in that boring. Although the soil was not stained, a sample of the soil contained TCE (0.042 mg/kg) and xylenes (0.0014 mg/kg).
- Previous researches have identified the silt unit as a "clay", "silty clay" or "clayey silt". Because observations of this unit have been inconsistent between researchers and the grain size data indicates that silt is the primary component (>76 %), GeoInsight proposes to simply this classification to a silt unit. Distinct clay units, other than observations of thin clay layers, were not observed in the FDDA.

3.2 HYDROLOGY

3.2.1 Surface Water Flow

The Aberjona River trends approximately north-south through the Wells G & H Superfund site and flows to the south. Along the north portion of the 60 Olympia Avenue property, the river flows through a relatively straight channel. The channel is approximately 10 to 15 feet wide and approximately one to two feet deep (depending upon seasonal water levels). Near the center of



the 60 Olympia Avenue property, the river enters a broad flood plain that is generally identified and occupied by an extensive wetland. A beaver dam located near the north end of the wetland area currently controls surface water flow of the river into the floodplain area.

Within the wetland area, the river follows several small meandering channels (primarily an eastern and western channel) depending upon seasonal water levels. The western channel is located within 30 feet of the western wetlands border with the upland area where the FDDA is located.

Topography at the FDDA is flat. The FDDA is located in a small upland area that is bordered to the west by the railway easement, and to the east and south by a soil berm of varying height (maximum height of approximately 5 feet) that forms a border with wetlands to the east and south. In the vicinity of the FDDA, the direction of surface water runoff flow is estimated to be to the south.

3.2.2 Ground Water Flow

Depth to ground water in the FDDA is very shallow, generally less than two to three feet BGS. The direction of shallow ground water flow is to the east-southeast, toward the Aberjona River and bordering wetlands. Copies of BRE's Figure 3-4 and TRC's Figure 2.9 that indicate the historical direction of ground water flow are included in Appendix A. The slope of the water table within the central river valley is generally low, and horizontal hydraulic gradients measured by the USGS and BRE in the vicinity of the FDDA generally ranged from 0.004 to 0.01 feet per foot. Data obtained by the USGS indicate that the direction of ground water flow in the deep overburden in the vicinity of the FDDA was also to the east-southeast, toward the Aberjona River.

The direction of ground water flow in the center of the river valley (underneath the wetlands areas to the east of the FDDA) is to the south, parallel to the axis of the valley and the river.

Data obtained by the USGS indicated that the average horizontal hydraulic gradient along the



center of the valley is approximately 0.001 feet per foot (ft/ft) and that vertical hydraulic gradients in this area are upward. Because of the relative differences in the permeability of the shallow layer of silty soils in the FDDA compared to the much more transmissive nature of the underlying sands and gravels, the shallow portions of the FDDA may be partially connected to the main aquifer system (i.e., the quantity and velocity of ground water flow through the FDDA is significantly less that for the surrounding areas).

GeoInsight estimated horizontal and vertical gradients in the FDDA using well couplets OL-002/OL-2M and OL-003/OL-3M. The shallow wells (OL-002 and OL-003) are screened from 4 to 9 feet BGS and the deeper wells, designated with the "M" are screened from 21.5 to 31.5 feet BGS. Gauging data collected on June 2, 2003 indicated horizontal gradients ranged from 0.0032 to 0.0045 ft/ft in the FDDA. Vertical gradients appeared to be upward ranging from 0.017 to 0.022 ft/ft. Upward vertical gradients are anticipated near the main channel of the Aberjona River.

Ground water velocities in the Aberjona River valley are significantly greater than velocities in the FDDA. The Darcy velocity for the Aberjona aquifer was estimated in the Record of Decision (ROD) to be 0.25 feet per day. This value is reflective of the sandy materials that are the predominant lithology within the Aberjona aquifer. Darcy velocities estimated for the FDDA are significantly lower ranging from 0.003 ft/day to 0.03 ft/day, one to two orders of magnitude lower that values for the main aquifer. Based upon the slow rates of ground water flow within the FDDA, and especially with in the silt unit, pore water flushing of the silt unit is not considered to be significant. Distribution of subsurface impacts appears to be controlled by gravity drainage (primary DNAPL migration mechanism) through preferential pathways (sand lens) and diffusion (into silt).

3.3 DELINEATION OF VOC IMPACTS

Dissolved concentrations of VOCs are elevated in shallow ground water at the Olympia Property. TCE concentrations in ground water samples obtained from shallow monitoring wells within the FDDA are generally on the order of several hundred to several thousand ug/l (Tables

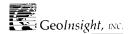


1A and 1B). Other VOCs, including PCE, cis-DCE, vinyl chloride (VC), ethylbenzene, and xylenes, were detected at much lower concentrations, generally ranging up to several hundred ug/l (Tables 1A and 1B). The presence of cis-DCE and VC in shallow ground water is likely attributable to the degradation of TCE and PCE via reductive dehalogenation.

During characterization activities completed within the FDDA, the extent of VOC impacts were characterized using PID field screening methods and laboratory confirmation of select samples. Elevated VOC concentrations were generally detected at depths ranging from 6 to 18 feet BGS. The highest headspace screening results and laboratory concentrations were detected in samples obtained from the sand silt interface or from within the silt layer. Headspace screening results for soil samples collected above and near the base of the silt layer were at or below detection (Figures 5 and 6). Laboratory VOC analyses confirmed that the VOCs were primarily present within the silt layer and that the primary compounds consisted of TCE and DCE, with lesser concentrations of PCE.

The horizontal distribution of VOCs within the FDDA are illustrated on Figures 7 through 9. Figure 7 summarizes the results of PID headspace screening measurements and laboratory analytical results for saturated zone soil samples. Figure 8 illustrates the distribution of TCE based upon the analyses of ground water samples obtained in 2002 and 2003. TCE concentrations are contoured to illustrate the distribution of dissolved TCE greater than 5, ug/l, 1,000 ug/l, 10,000 ug/l, and 100,000 ug/l. TCE concentrations greater than 1% of solubility (10,000 ug/l) may be indicative of the presence of DNAPL ganglia in FDDA soil. TCE impacts in ground water extend from the vicinity of wells GEO-4 and GEO-SB-102 in the north to wells OL-003 in the south. The highest VOC concentrations are located within the silt unit.

Figure 9 illustrates the maximum concentrations of TCE detected in saturated zone soil samples. A comparison of Figures 8 and 9 indicates that the distribution of TCE based upon laboratory results for ground water and saturated zone soil are similar. Figures 8 and 9 also indicate that elevated concentrations of TCE occur primarily within the upland area in the FDDA and that TCE concentrations in ground water decrease substantially within the central river valley to the east and southeast.



3.4 GROUND WATER GEOCHEMICAL CONDITIONS

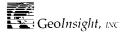
Analyses of ground water conditions within the FDDA during recent assessment activities included total and/or dissolved iron and manganese concentrations and field parameters (i.e. pH, ORP, DO). A summary of historical field parameter data and measurements obtained during recent investigation activities at specified well locations and depths are summarized in Table 5. Total and/or dissolved iron and manganese concentrations are presented in Table 6.

The pH of ground water within the FDDA ranges from 5.86 to 6.77. Dissolved oxygen concentrations within the FDDA were typically low and generally ranged from 0.1 to 3.61 mg/l. ORP of the ground water samples within the FDDA typically ranged from 49 to 192 millivolts and indicated generally aerobic conditions. Slightly negative ORP values measured in ground water from the most impacted wells (OL-002, OL-003, and Test-1) indicate that within the area of greatest VOC impacts, ground water conditions may be slightly anaerobic.

Results of the ground water dissolved iron analyses indicate that the highest concentration (7,500 ug/l) was detected in the ground waters sample obtained from the downgradient edge of the silt unit (GEO-3). A comparison of the limited inorganic ground water quality from this area suggested that iron was present as a particulate phase (i.e., dissolved iron concentrations were low; Table 6).

3.5 SOIL - TOTAL ORGANIC CARBON

The presence of total organic carbon (TOC) in vadose and saturated zone soils can affect the rate of migration and transport behavior of organic constituents. TOC was measured in soil samples obtained within the FDDA to assist the evaluation of fate and transport of TCE in soil and ground water. TOC detected in the shallow soil samples obtained from the FDDA ranged from non-detect to 2,200 mg/kg (Table 7). The average organic carbon content (calculated by using half the detection limit for non-detected TOC values) for the silt unit was 540 mg/kg. These values, which are less than one percent, are considered to be low values. Therefore, the amount



of organic material present within the sand and silt unit in the FDDA is low and may not be expected to absorb a significant mass of dissolved VOCs from the ground water. It must be noted that the FDDA is heterogeneous with multiple types of layered materials and that the organic content of thin clay rich layers has not been quantified. Based upon a few sand samples, it appears that the sand layers contain less organic matter than the silt unit.

3.6 SITE-SPECIFIC SORPTION

The sorption potential of subsurface soils within the FDDA was evaluated using the results of analytical testing of soil and ground water samples that were collected from similar depth intervals at the same location during the focused geoprobe investigation. This approach attempted to capture real time discrete soil and ground water concentrations for a qualitative evaluation. This revised evaluation of site specific sorption incorporates the potential for DNAPL ganglia. Due to the potential presence of DNAPL ganglia and the observed discrete ground water samples that exceeded 1% of TCE solubility, this discussion is qualitative.

Sorption potential is primarily dependent on the amount and nature of organic carbon present in soils. The nature and sorption potential of organic carbon is dependent on the depositional environment, as carbon from older glacial deposition has relatively higher sorption potential than carbon from in recent wetland organic rich deposition. The amount of organic carbon at the Olympia Property is generally very low (not detected to less than 0.22 percent) in the sand and silt units within the FDDA (i.e., the areas where the highest VOC concentrations were detected).

To evaluate the distribution of VOCs between the solid and aqueous phase, GeoInsight collected in-situ samples of soil and ground water from the same location and stratigraphic interval on the same day (see Section 2.2.2). The ground water samples were collected using a sampling probe that contained an approximate 1.5 to 2-foot screened interval. In general, the ground water sampling probe was positioned so that the center of the screened interval was positioned at the depth where the soil sample had been collected. The ground water sampling probe was advanced directly adjacent to the boring that was used to collect the soil sample (within a 1 to 2 feet of the soil boring location).



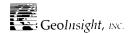
To evaluate sorption potential, soil and ground water conditions within the FDDA were assumed to be at equilibrium for pairs where the ground water concentration was less than 2% of TCE solubility (see Table 10). Pairs above 2% solubility could not be used due to sample mass balance inconsistencies (i.e. negative numbers). This assumption is considered to be reasonable for the Olympia Property based upon the length of time since the release of VOCs occurred (i.e., several decades), a review of historical data that suggest conditions within the ground water plume have not changed appreciably over the last 15 years, and the local hydraulic conditions (i.e., shallow hydraulic gradients and slow ground water flow through the FDDA). Samples pairs that exhibited ground water concentrations greater than 2% TCE solubility were assumed to be not at equilibrium due to the potential for the presence of DNAPL ganglia.

GeoInsight estimated the sorption partitioning coefficient (K_D) for TCE using the equation:

$$K_D = C_S / C_w$$

where C_s and C_w are the concentration of TCE in soil and ground water, respectively. K_D was subsequently normalized for each sample pair by dividing by the fraction of organic carbon to develop the organic carbon partitioning coefficient K_{oc} . K_{oc} values have historically been assumed to be constant for a specific compound (e.g., TCE). However, recent research has indicated that K_{oc} can vary depending on the nature of the organic matter. Literature values for K_{oc} for silty and sandy aquifer materials (ranging in TOC from 210 mg/kg to 3,400 mg/kg) range from 128 to 500 (Allen-King et al, 1997).

Sorption calculations, using ground water and soil concentration pairs, are presented in Table 10. It is important to note that the soil samples were collected below the water table (i.e., saturated), and therefore, the total TCE mass detected in the soil samples is derived from both TCE adsorbed to soil and TCE dissolved in ground water present in the soil pore space. The laboratory reported soil concentrations were adjusted by GeoInsight ("adjusted C_s concentration") to account for TCE mass present in the soil pore water. The TCE mass present in the moisture of the soil sample was estimated using the TCE concentration in the corresponding ground water sample and the moisture content of the soil sample.



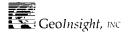
As presented in Table 10, when TCE mass attributed to ground water in the soil pore space is subtracted from the reported soil concentration, some of the adjusted soil concentration (C_s) values are negative, indicating that TCE mass in ground water alone could account for the TCE mass detected in the soil sample. This apparent discrepancy in the mass balance of TCE in the soil samples indicates non equilibrium conditions. However, this exercise suggests that TCE mass may be present in ground water in the dissolved phase and as DNAPL ganglia.

In boring GEO-SB-102, a sand layer was observed from 10 to 13.5 feet BGS. Two soil samples were collected from this boring; one sample from the sand unit at 10 to 13.5 feet BGS and one sample from the silt unit at 13.5 to 14.5 feet BGS. One ground water sample was collected from a depth interval of approximately 13 to 14.5 BGS. Consequently, this ground water sample likely consisted of ground water from both the sand and silt units. The results of the soil sample analyses indicated that the concentration of TCE in the sand layer is much lower than the concentration in the silt layer at this location. This is attributed to extremely low to non-detected concentrations of TOC in the sand layer. The water sample from this interval more likely represents water in the higher permeable sand observed in this boring. Data from this location were not used o estimate $K_{\rm OC}$.

The soil and ground water sample pair for GEO-SB-101 collected at 18 feet BGS indicated a relatively high TCE concentration in soil compared to the relatively low TCE concentration in ground water yielding an anomalous (very high) K_{oc} result (3,590). Because this water sample was collected from the bottom of the silt unit, the relatively low dissolved TCE concentration in this sample may be representative of ground water drawn from the relatively un-impacted lower portions of the silt unit in this area.

3.7 ESTIMATE OF VOC MASS IN SUBSURFACE

Based upon the results of the soil boring program and a review of the relationship between PID field screening measurements and VOCs detected in soil samples, TRC estimated that approximately 11,500 cubic yards of saturated zone soil within the FDDA contained TCE at concentrations above the ROD target cleanup level of 0.0127 mg/kg.



The mass of VOC within the upper sand and silt units within the FDDA was estimated using basic assumptions regarding stratigraphy and conservative uniform concentrations for soil and ground water (see Appendix H). The volume of ground water was estimated to be 30 percent by volume of the saturated soil. The impacted area (Figure 9) is approximately 100 feet wide and 180 feet long. The top six feet were estimated to contain relatively low concentrations of residual VOC impacts. A general mass estimate for the depth interval from 6 to 18 feet was calculated for the total area using moderate VOC impact concentrations. Two "hot spots" in the vicinity of wells OL-002 and MW-013 were included in the estimate. These hot spots were estimated to be 12 feet thick (depth interval of 6 to 18 feet BGS) and 3,600 square feet and 1,500 square feet in area, respectively. Within the hot spot areas, mass calculations were estimated using maximum concentrations of VOCs. Based upon these assumptions, the estimated mass of VOCs in the FDDA subsurface was conservatively estimated to be approximately 2,000 pounds of VOCs. Please note that this estimate assumed that TCE was present adsorbed to soil or dissolved in ground water at concentrations up to 60% of TCE solubility. The extremely high concentration in ground water are believed to include the potential DNAPL ganglia.

3.8 SUMMARY OF SITE CHARACTERISTICS – REMEDIAL CONSIDERATIONS

Ground water concentrations (greater than 1% of TCE solubility) indicate that DNAPL ganglia are present in pore spaces within the FDDA silt unit. FDDA geologic characteristics indicate that the silt unit is stratified and has limited the vertical migration of solvent (i.e., TCE concentrations in soil and ground water decrease to below detectable levels at depth within the silt unit). The silt unit is characterized by low permeability soil materials. Advective flow of ground water through the silt unit is slow, and the area of impacts does not appear to receive extensive pore water flushing.

The highest concentrations of VOCs were detected at depths between 6 and 18 feet within the silt unit underlying the FDDA. The primary VOC present in ground water is TCE. Concentrations of TCE detected in ground water samples obtained from monitoring well MW-011M (located approximately 80 feet south of the FDDA and screened from a depth of 40 to 50 feet BGS)



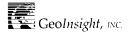
indicate that concentrations of TCE in the central valley sand aquifer are two orders of magnitude less than concentrations in the FDDA silt unit. These data suggest that the plume of dissolved VOCs that originates in the FDDA is subject to attenuation mechanisms when the impacted ground water migrates into the central river valley.

The silt unit is characterized as heterogeneous layers of silt with varying amounts of fine sand and clay, with occasional sand lenses. Hydraulic conductivity values calculated for the surficial layer of sand ranged from 3.1 ft/day to 129 ft/day (OL-002, BRE test data; OL-003, TRC test data). Hydraulic conductivity values calculated for the silt unit ranged from 0.34 ft/day to 2.7 ft/day (Test-1 and MW-013, TRC test data). Ground water flow is primarily horizontal in this unit and was observed to flow from north to south. The horizontal gradient within the silt unit ranged from 0.001 to 0.006 ft/ft based upon data obtained in 2002 and 2003. Grain size analyses indicated that the silt unit is greater than 76% silt with small percentages of fine sand and clay. PID headspace screening measurements and the results of soil sample analyses indicate that the silt unit has limited the vertical migration of VOCs within the FDDA.

The silt unit is characterized by low organic carbon content. An evaluation of site-specific sorption indicated that the silt layer sorbed more strongly than the sandy materials, possibly due to the presence of low concentrations of organic material in the silt unit. The lower organic content in the sand unit will reduce sorption potential and allow greater dissolution of VOCs into the aqueous phase within the sand lens.

Geochemical data indicated that shallow ground water conditions in the FDDA were relatively neutral to slightly aerobic. DO was relatively low for the aquifer with localized increase in DO near the sewer line. Slightly negative ORP values were observed in wells that exhibited high VOC concentrations. In general, geochemical conditions within the FDDA are not currently optimal for biodegradation and appear to be nutrient limited.

According to information summarized to develop the CSM for the Olympia Property, the primary factors associated with environmental quality conditions and remedial considerations in the FDDA include the presence of the relatively low permeability silt layer and the relatively



shallow depth of the VOC impacts. TCE impacts within the FDDA appear to predominantly be associated with dissolved TCE and localized DNAPL ganglia within ground water that occupies the pore spaces of the silt unit and sand lens. The presence of the silt layer has limited the horizontal and vertical migration of TCE in ground water within the FDDA. Darcy velocities indicate ground water flow ranging from 0.003 ft/day to 0.03 ft/day. Based upon the relatively low permeability of the silt unit, the TCE has not been subjected to significant flushing and attenuation mechanisms. Consequently, to be effective, remedial technologies must address all three phases (adsorbed, dissolved, and DNAPL ganglia) of impacts within the silt layer. The success of these methods will depend upon the ability to physical remove and treat these material ex-situ, or deliver and distribute of remedial amendments throughout the impacted area.



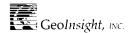
4.0 REMEDIAL OBJECTIVES

4.1 INTRODUCTION

As specified in Section VIII of the Order, associated response actions were to include additional characterization of TCE-impacted soils and an evaluation of and recommendation for clean up technologies to address the TCE-impacted soils at the Olympia Property. Based upon a review of historical information, and the results of focused additional field investigation activities completed under the Order, TCE is present in the subsurface within the FDDA as a dissolved phase in ground water, as an absorbed phase to soil, and as a separate phase (i.e., DNAPL ganglia). The majority of TCE appears to be located within the silt unit at depths between 6 to 18 feet BGS.

The evaluation completed in this Work Plan focused upon remedial technologies to address TCE-impacted soil and ground water present within the shallow silt unit in the FDDA. Remedial goals for the FDDA will be primarily focused upon reducing VOCs in ground water at the Olympia Property to concentrations that are below applicable drinking water standards (including within the FDDA). As such, modifications to the ROD-specified soil clean up standards for the FDDA was not considered critical for conducting response actions at the Olympia Property (i.e., regardless of theoretically calculated soil clean up standards, conditions within the FDDA must be addressed so that concentrations of VOCs in ground water are below drinking water standards).

Because the drinking water standards for the VOCs present within the FDDA are very low (i.e., single digit ug/l), and based upon the general characteristics of the FDDA and the types of remedial technologies included in this evaluation, it is expected that implementation of a remedial alternative will address conditions associated with DNAPL ganglia, TCE dissolved in ground water, and TCE-adsorbed to soil that may be present within the FDDA.



4.2 CLEAN UP GOALS

The ROD established clean up goals for ground water at the Wells G & H Superfund Site to be protective of human health via direct ingestion and to be protective of the ground water resource associated with the central valley aquifer located beneath the Aberjona River. Consequently, clean up goals for VOCs in ground water at the Wells G & H Superfund Site were established based upon applicable federal drinking water standards. These drinking water standards for the VOCs that are present within the FDDA are very low, and range from 2 ug/l for vinyl chloride to 5 ug/l for TCE and PCE. Because ground water at the Olympia Property and within the central valley aquifer is not currently used for drinking water, potential risk associated with ground water conditions within the FDDA are associated with theoretical future use of the aquifer as a drinking water resource.

For response actions completed within the FDDA, clean up goals for VOCs will be federal drinking water standards (these standards are consistent with ground water standards presented in the ROD).

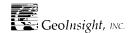
The Feasibility Study that was completed in 1989 included an evaluation of potential soil cleanup levels for the Wells G & H Superfund Site source areas. For the Olympia Property, the soil cleanup levels for TCE were developed to be protective of ground water conditions within the central river valley aquifer. The FS included an evaluation of the concentrations of TCE that could be present in soil without resulting in impacts to ground water in the central river valley above the applicable ground water standard (5 ug/l). The FS evaluation used a two-dimensional soil leaching model (referred to as the Summers Model) to estimate target TCE cleanup levels in soil. The evaluation used soil organic carbon absorption coefficients (K_{oc}) values for TCE derived from a literature source. The target TCE concentration in soil of 12.7 ug/kg that was estimated for the Olympia Property during the FS using the Summers Model was incorporated in the 1989 ROD.



In 1998, BRE revised the FS soil cleanup level evaluation based upon the results of additional investigation activities. The Summers leaching model was revised to include a site-specific measurement of organic carbon content and additional information on the depth of the central valley aquifer in the vicinity of the Olympia Property. The revised soil cleanup level estimated by BRE using the additional information was 79 ug/kg. However, organic carbon content appears to be over estimated in the BRE model.

The August 7, 2003 draft of the Work Plan presented a comparison of the Summers leaching model using ROD values, BREs values, and site-specific values estimated by GeoInsight. However, Revised Work Plan does not rely upon soil leaching estimates due to the variability of sorption data and the presence of localized DNAPL ganglia.

USEPA has indicated that the cleanup for the FDDA should reduce concentrations to applicable standards, without reliance on attenuation mechanisms to reduce concentrations to target levels at a down gradient compliance point. As previously described, the development of a site-specific clean up goal for TCE in soil is not considered appropriate because of the variable sorption potential of different matrix materials present in the FDDA. The effectiveness of remedial actions within the FDDA will be based upon achieving ground water clean up goals. Once ground water standards are achieved, soil data will be obtained to confirm the reduction in soil concentrations to ROD-specified clean-up goals.



5.0 REMEDIAL OPTIONS

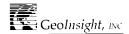
Remedial options for conditions associated with each of the five source areas of the Wells G & H Superfund site were first evaluated during the FS that was completed in 1989. Based upon the results of these evaluations, preferred remedial alternatives were selected for each of the source areas and these remedies were summarized and presented in the ROD (1989). For the Olympia Property, the ROD indicated that the preferred remedial alternative was the extraction and treatment of ground water. In addition to the five source area, the ROD indicated that a separate decision document would be prepared for the central aquifer area, including the central Aberjona River valley and the areas directly adjacent to the east portion of the FDDA.

Based upon the CSM described in Section 3.0, previously proposed technologies and potentially applicable current technologies were evaluated with regard to their ability to address conditions at the Olympia Property and achieve remedial action goals for soil and ground water (i.e., target cleanup levels).

Current technologies that are most typically used to address impacts in soil and ground water by chlorinated solvents include:

- Ground Water Extraction:
- Air Sparging/Bio-Sparge with Soil Vapor Extraction;
- High Vacuum Extraction/Dual Phase Extraction;
- Augmented In-Situ Bioremediation;
- Chemical Oxidation;
- Soil Excavation: Large Scale;
- Soil Excavation: Targeted Excavation; and
- Bioremediation.

An initial screening was completed to evaluate if these technologies would be readily applicable to the conditions and extent of impacts present at the Olympia Property. The technologies that were most suited to site conditions were retained for the detailed evaluation. The following section provides a brief summary of the remedial technologies included in the initial screening evaluation.



5.1 GROUND WATER EXTRACTION AND TREATMENT

Ground water extraction (GWE) is used to recover impacted ground water and exert control over local hydraulic conditions (i.e., limit or contain the continued migration of dissolved VOCs). Recovered ground water is treated on-site and discharged to surface water or injected below grade. On-site water treatment is most commonly performed via air stripping or granular activated carbon. GWE results in the overall reduction of the mass of VOCs dissolved in ground water.

GWE remedial systems are generally most effective in hydrogeologic settings that are characterized by relatively permeable soils and where ground water impacts are localized and the constituents are readily soluble. The efficiency of the remedial alternative is generally dependent upon the ability to remove multiple pore water volumes through the impacted area (i.e., flushing dissolved constituents from the subsurface) and the mass of VOCs that have adsorbed onto saturated zone soil grains. Because even small quantities of organic matter can significantly absorb VOC mass to soil grains, and flushing multiple pore volumes through impacted areas takes many years, GWE is not generally effective at reducing concentrations of chlorinated VOCs in ground water to levels that approach drinking water standards.

The FDDA is characterized primarily by silty soils that have low permeability. The results of pump tests completed by TRC indicated that it would be difficult to remove significant quantities of ground water from the FDDA (i.e., the extraction wells would be operated at very low pump rates) and that extraction wells would have limited areas of influence. Based upon hydraulic conditions within the FDDA, GWE was not retained for detailed evaluation.

5.2 AIR SPARGE/BIOSPARGE WITH SOIL VAPOR EXTRACTION

Air sparge and biosparge remedial technologies involve the injection of air (or oxygen) into the saturated zone below the water table. Air sparge is typically operated under higher injection pressures and flow rates and the technology relies upon the stripping of VOCs from ground



water as the injected air migrates vertically through the saturated zone. Air sparge is typically used in conjunction with soil vapor extraction (SVE) so that VOC vapors can be recovered above the water table. Biosparge involves injecting air (or oxygen) at lower flow rates and relies on biodegradation rather than volatilization for VOC treatment/removal. Both technologies typically create air flow channels in a limited volume of the subsurface located near the injection points. VOCs in these channels are either volatilized due to aeration or biodegraded aerobically in the oxygen-rich environment. It is important to note that several chlorinated VOCs, such as PCE, generally require anaerobic conditions for biodegradation. Diffusion gradients can be established towards air flow channels to increase the effective influence of sparging.

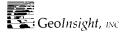
SVE is typically operated concurrently with air sparge systems to recover VOC vapors in the vadose zone. SVE is the process of recovering vadose zone soil vapors using a vacuum pump. Recovered SVE vapors are typically treated with activated carbon or catalytic oxidation prior to discharge to the atmosphere. Due to the high water table at this site, SVE would be difficult to implement because the vacuum would entrain significant amounts of ground water into the air stream (i.e., the SVE system would have to be constructed at, or above, the current ground surface within the FDDA).

The FDDA is characterized by soils that have relatively low permeability and local stratifications. Pre-design studies would be necessary to evaluate the potential for significant channeling and horizontal incursions of air flow and the ability to achieve equal distribution of air within the FDDA.

Based upon FDDA soil and hydraulic conditions, Air sparge, SVE, and biosparge were not retained for the detailed evaluation because it is not likely that significant zones of aeration could be created within the silt unit.

5.3 HIGH VACUUM EXTRACTION/DUAL-PHASE EXTRACTION

High vacuum extraction (HVE)/dual-phase extraction (DPE) is a remedial technology that extracts ground water and soil vapors from one or more extraction wells. The high applied



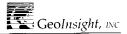
vacuum results in increased ground water recovery when compared to typical GWE, and the ground water extraction exposes the "smear zone" and increases the vadose zone soil available for SVE. HVE is accomplished using a single pump, high vacuum system in relatively low permeability formations. DPE uses submersible ground water pumps and a separate SVE blower for higher permeability formations. Capital and operation/maintenance costs for HVE/DPE are more expensive than for GWE or SVE due to the equipment required and the need to treat and dispose of both liquid and vapor streams. Recovered water and vapor are typically treated via air stripping or granular activated carbon.

HVE/DPE was not retained for the detailed evaluation based upon the expected limited radius of influence for HVE/DPE extraction wells and possible interferences associated with the layer of higher permeability sand located above the silt unit (i.e., preferential recovery of relatively unimpacted ground water).

5.4 AUGMENTED IN-SITU BIOREMEDIATION

In-situ bioremediation involves the treatment of soil and ground water in-place through addition/delivery of a nutrient source, electron donor, and, if warranted, appropriate microorganisms. Necessary biomaterials are typically delivered into the subsurface through a series of injection points or wells. Bacteria or other microorganisms present in the subsurface consume or degrade compounds adsorbed to soil or dissolved in ground water. The results of historical ground water quality monitoring completed within the FDDA suggested that TCE and PCE have undergone in-situ degradation via reductive dehalogenation to the daughter products cis-DCE and vinyl chloride. These data suggest that conditions within the FDDA may be amenable for augmented in-situ bioremediation.

Because in-situ bioremediation has been demonstrated to be effective at remediating chlorinated VOCs, and available data suggest limited natural degradation of VOCs in ground water has occurred at the Olympia Property, the remedial alternative was retained for detailed evaluation.



5.5 CHEMICAL OXIDATION

Chemical oxidation involves injecting an oxidizing chemical solution, such as sodium permanganate, potassium permanganate, ozone, or hydrogen peroxide (Fenton's Reagent), into subsurface impacted areas. Oxidation of potentially-oxidizable materials, such as hydrocarbons, organic matter, and reduced compounds, will occur on contact with the solution. Fenton's Reagent and permanganate solutions have been shown to be effective in destroying VOCs, including PCE and TCE, in ground water and soil. However, because Fenton's Reagent is comparatively unstable and it is difficult to introduce Fenton's Reagent into the impacted areas before the reaction is complete, this evaluation focused upon permanganate which is easier to handle and remains chemically active for a longer period.

Depending upon the characteristics of the area to be treated, the oxidant is typically delivered to the subsurface via injection wells or points. A sufficient volume of oxidant must be delivered to address the total demand of the subsurface area, including the natural demand of the soil as well as the VOC demand. The oxidant solution is typically delivered into the subsurface under gravity or low-pressure injection. Gravity drainage can be achieved by flooding the unsaturated zone above the target treatment zone to create a slight downward pressure head. Low-pressure injection (a few feet of pressure head) is achieved by containing oxidant in the well casing above grade or connecting the well to an oxidant reservoir. Consequently, the delivery system requires simple equipment and support systems.

Soil and ground water impacts within the FDDA are shallow and generally present to a maximum depth of 16 to 18 feet BGS. In addition, soil conditions are conducive to the installation of a wide range of oxidant delivery systems (i.e., horizontal or vertical wells, recharge galleries, trenches, etc.). Therefore, chemical oxidation (using permanganate) was retained for detailed evaluation.



5.5.1 Permanganate Demand Testing

The collection and selection of saturated zone soil samples for permanganate demand testing were discussed in Section 2.2.3. The testing included one sample obtained from the upper sand layer, eight samples obtained from the underlying silt layer, and two samples of peaty material located adjacent to the wetlands at the southeast corner of the FDDA. Groundwater Analytical Inc. conducted permanganate demand testing.

The eleven individual soil samples were each split into three replicate samples by the laboratory and a dilute solution (0.5 percent) of potassium permanganate was added to each replicate and mixed in a closed container. The solution was sampled every three days over a period of approximately 30 days, and the permanganate concentration in the solution was measured over time. Residual permanganate concentrations in samples over time were measured photometrically to estimate the amount of permanganate consumed by the sample. The individual data from the three replicate samples were averaged together to estimate the permanganate demand on the original sample. Permanganate test results are summarized in Table 9 and a copy of the laboratory analytical report is included in Appendix G.

The results of the permanganate demand test indicated that in general, the sand sample consumed less permanganate than the average demand of the silt samples. Samples of peat and organic rich soil from downgradient locations within the FDDA consumed the greatest quantity of permanganate (these samples consumed all the permanganate that was added). This condition was probably the result of the high organic carbon content of these soil samples.

The results of the permanganate demand test by stratigraphic unit are summarized below.

Subsurface Material	Permanganate Demand (Moles per Kg soil)		
	Range	Average	
Sand	0.0020	NA	
Silt	0.0011 to 0.0090	0.0034	
Peat and Organic Soil	>0.0532 to >0.2343	NA	

5.6 MONITORED NATURAL ATTENUATION

Monitored natural attenuation is the process whereby VOCs in soil and ground water diminish over time via natural degradation processes, including volatilization, mineralization, dilution, dispersion, and biodegradation. Although conditions at the site are monitored to document continued attenuation of the VOCs, active remedial measures are not typically employed. Monitored natural attenuation is most applicable for sites where the release source has been removed and monitoring data indicate that impacts to soil and ground water are diminishing over time. Use of monitored natural attenuation at these sites generally requires characterization data that demonstrate geochemical conditions are conducive to continued degradation and attenuation of the VOCs.

The results of historical water quality testing indicate the presence of cis-DCE and vinyl chloride (breakdown products of PCE and TCE) in ground water samples obtained from downgradient monitoring wells. These data suggest that biodegradation mechanisms are active within the FDDA. However, these data also suggest that the rate of biodegradation is slow, and that remedial objectives for ground water are not likely to be met within the FDDA within a reasonable time frame based solely on natural attenuation mechanisms. Therefore, monitored natural attenuation was not retained for detailed evaluation.



5.7 SOIL EXCAVATION

Soil excavation involves the removal of soil (vadose zone and saturated zone soil) that contains TCE at concentrations above the applicable target cleanup level. Soil removed from the ground is either treated on-site and placed back into the excavation, or transported off-site for disposal. Because most of the impacted soil at the Olympia Property is located below the water table, the area to be excavated would require shoring and dewatering. Liquids generated during dewatering activities are typically treated on-site using granular activated carbon. Soil and ground water impacts within the FDDA are shallow and generally occur to a depth of 16 to 18 feet BGS. These soils are readily accessible using standard excavation equipment. Therefore, soil excavation was retained for detailed evaluation.

5.8 SUMMARY OF INITIAL SCREENING OF REMEDIAL TECHNOLOGIES

Based upon the results of the initial screening of remedial alternatives, three remedial technologies were retained for detailed analyses, and summarized in the following table:

Technology	Retained for Detailed Evaluation	Not Retained for Detailed Evaluation
Ground Water Extraction and Treatment		X
Air Sparge with Soil Vapor Extraction		X
Biosparge		X
High Vacuum Extraction/Dual-Phase Extraction		X
Augmented In-Situ Bioremediation	X	
Chemical Oxidation	X	
Soil Excavation	X	
Monitored Natural Attenuation		X

5.9 DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

The three remedial technologies retained for detailed evaluation included:

Augmented in-situ bioremediation;



- Chemical oxidation; and
- Soil excavation.

As specified in the SOW, these remedial technologies, and combination of technologies, were evaluated with regard to developing a technically sound approach to satisfying the requirements of the Order. Because data obtained to date suggest that the greatest TCE impacts are present within the center of the FDDA, and impacts diminish in the outer portions of the FDDA, remedial alternatives that combined different technologies were also evaluated. Discussions of these remedial alternatives are included in the following sections.

The area that requires remediation was approximated using the 1,000 ppb in ground water contour interval. A "box" that surrounds this area was estimated to be 80 feet wide and 160 feet in length. GeoInsight proposes to remediate soils to 20 feet depth. The area includes approximately 9,500 cubic yards of soil.

5.9.1 Soil Excavation Alternatives:

Remedial Alternative 1A: Soil Excavation with Off-Site Treatment and Disposal.

This remedial alternative includes the excavation and off-site disposal of approximately 9,500 cubic yards of impacted saturated-zone soil from within the FDDA. Soils will be removed from the approximately 160 foot long, 80-foot wide area where TCE impacts are greatest to a depth of approximately 20 feet BGS. Based upon the required depth for soil removal activities, excavation activities will be performed using an excavator.

Based upon soil types and the required depth of soil removal, soil excavation activities will require the installation of a sheet pile wall around the perimeter of the area to be excavated. Within the sheet piled area, shoring will be employed in the vicinity of the excavator during soil removal activities. Based upon space constraints within the FDDA, large-scale excavation activities will be conducted in stages, with clean fill brought in periodically at the end of each stage to replace the excavated material and create additional work space.



Dewatering within the sheet pile wall and soil excavation and treatment of extracted water will be required prior to and during soil excavation activities. Water removed from the excavation area will be temporarily stored on-site in a Frac tank and treated via granular activated carbon. The treated water will be discharged locally to the Aberjona River wetlands located to the east of the FDDA.

Based upon characterization activities completed to date, the soils within the FDDA do not meet the requirements of a characteristic hazardous waste. Because of space constraints at the Olympia Property, the excavated soil will be live loaded for transportation to an off-site disposal facility. Consequently, prior to implementation of the remedial alternative, additional soil characterization and sampling of saturated zone soils will be completed and these data will be used to obtain approval for off-site disposal.

Truck access to the Olympia Property is via a dirt path from the Wildwood Conservation Trust property to the south. This dirt path and associated bridge structures will be upgraded to accommodate soil excavation equipment and soil transportation trucks. Based upon the estimated volume of soil to be removed from the FDDA, it is estimated that off-site disposal will include approximately 475 to 530 loads of soil (based upon 18 to 20 cubic yards per load). The structural integrity of the dirt path and bridges will be upgraded to accommodate this level of truck activity.

Remedial Alternative 1B: Soil Excavation with On-Site Stabilization - Using Asphalt Emulsion and Portland Cement.

Rather than off-site disposal, this remedial alternative includes ex-situ mixing and stabilization via asphalt emulsion and Portland cement. The area of excavation activities would be similar to that for Remedial Alternative 1A. Soil removed from the excavation area will be placed in a mobile, on-site pug mill and processed for on-site stabilization. The stabilization process consists of mixing asphalt emulsion and Portland cement with excavated soil and returning the material to the excavation. After placement in the excavation, the stabilized soil hardens to a low permeability asphalt/cement material.



Similar to Remedial Alternative 1A, excavation activities will require the installation of a perimeter sheet pile wall, dewatering activities, and shoring during excavation. Based upon space limitations (available space within the FDDA for equipment staging and soil handling is limited to the west by wetlands and to the west by the sewer and railway easements), large-scale excavation would be conducted in stages, with stabilized soil placed back into the excavation as the work proceeds. The duration of field excavation and soil handling activities associated with this remedial alternative are expected to be longer than Remedial Alternative 1A based upon the requirements for on-site handling of soil associated with ex-situ soil processing. Preliminary evaluations of the applicability of this remedial technology and associated range of soil treatment costs were obtained from United Retek.

5.9.2 In-Situ Alternatives: Chemical Oxidation

The results of the permanganate demand study summarized in Section 5.5.1 were used to calculate the mass of permanganate required to address subsurface VOC conditions within the FDDA. The calculated mass of permanganate for the remedial program is based upon the mass of permanganate required to overcome the natural oxidant demand of the soil and the mass of permanganate required to oxidize VOCs present within the subsurface. GeoInsight assumed that 9,500 cubic yards (yds³) of soil require treatment, and that 25 percent of the soil volume (2,375 yds³) is sandy soil in the upper unit and 75 percent of the soil volume (7,125 yds³) is silty soil from the silt unit. For the permanganate consumption estimate, the soil was assumed to have a density of 3,000 pounds per cubic yard. GeoInsight also assumed that the area to be treated would not include an appreciable quantity of organic rich soil (e.g., organic soil encountered near the ground surface in boring GEO-SB-99) because this type of material has an extremely high permanganate demand and would consume large volumes of permanganate solution. The results of investigation activities completed to date indicate that organic rich soils are not present within the area that requires treatment.



The total amount of permanganate required to overcome the natural permanganate demand of the soil and oxidize the VOCs present in the subsurface (estimated to be approximately 2,000 pounds) is presented below and summarized in Appendix H:

Permanganate	Moles of	Pounds of KMnO ₄	Pounds of 40%
Demand	Permanganate	Powder	NaMnO ₄ Solution
Soil Demand	39,430	13,740	30,850
VOC Demand	13,800	4,810	10,800
Total	54,600	18,550	41,650

The primary consideration for remedial techniques that are based upon chemical oxidation is the design of the oxidant delivery system. In lower-permeability hydrogeologic settings, the oxidant solution primarily travels in the subsurface by diffusion. Oxidant solution delivery mechanisms included in this evaluation ranged from gravity feed via point wells (the standard delivery method) to direct application and mixing using a large earth auger (an innovative approach that has classically been used to stabilize soil using cement).

In designing remedial systems that are based upon chemical oxidation, the amount of permanganate that is calculated to address the natural and contaminant demand of the subsurface is typically multiplied by the safety factor to account for subsurface variability and unknown conditions. In evaluating normal permanganate injection, Carus Chemical, the permanganate supplier, normally uses a 4X safety factor to compensate for unknown conditions.

To account for unknown conditions, a safety factor of 4X was applied for the calculations of permanganate mass required for each of the remedial alternatives. However, the safety factor was increased for the soil mixing remedial alternative primarily because this technology has high mobilization costs and the desire to complete treatment in one mixing event (i.e., limit the need to perform multiple auger mixing events within the same area). For the soil mixing alternative a 5X safety factor was used in the cost estimating.



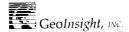
The chemical oxidation based remedial alternatives that were included in this evaluation are summarized in the following sections. Each of these technologies presents different methods for handling and distributing permanganate. GeoInsight anticipates that the different methods employed may help to reduce the overall amount of permanganate needed to treat the area. For instance, as discussed below, use of a sheet pile wall is expected to contain permanganate in an area of higher permeability. The cost estimates for these methods present a range that reflects safety factors for best and worst case scenarios related to permanganate consumption. Cost estimates are discussed in Section 5.10.

Remedial Alternative 2A: Soil Mixing and Potassium Permanganate Injection Using Earth Augers.

This remedial alternative utilizes large-diameter augers to mix permanganate solution in-situ with subsurface saturated soils. The augers are typically mounted on a track-mounted crane or drill rig that is connected to a pump system. Large-diameter auger technology has primarily been used to inject cement or grout for soil stabilization associated with construction activities. Although feasible by design, this technology has not been used as a chemical oxidant delivery system.

GeoInsight met with Raito Inc. (Raito) on December 8, 2003, to discuss potential logistics regarding implementing soil mixing at the site. Raito has conducted large scale projects (worldwide), primarily to stabilize soils using cement or grout for large scale construction projects.

The auger/mixing equipment is generally mobilized using 15 tractor trailers. The auger/mixing unit is constructed on site in a large open area, free of obstacles. The typical auger unit is relatively large because the equipment is typically used for large construction projects (i.e., smaller auger rigs are not available). GeoInsight anticipates that site preparation will include tree clearing and adaptation of monitoring well heads (outside of the treatment area) so that they are flush to grade and protected by concrete pads.



The auger/mixing unit is track mounted and does not exert significant loads to the underlying soil (i.e., the machine can be operated on top of and be driven over most typical soil types, including soils that were already mixed). The standard auger configuration is a "unit" composed of three separate augers connected in series (side by side). Each auger has a large diameter solid auger at the base that is used to create an initial "opening" in the soils. This bottom section of the auger is typically 2 to 5 feet long. The upper section of the auger consists of a small diameter hollow stem that has horizontal "paddles" configured along its length. The "effective diameter" of the paddles is slightly less than the diameter of the solid auger base, and typically is about 3 feet. Consequently, the auger unit has a "mixing footprint" of approximately 3 feet by 10 feet.

Reagent is fed into the auger unit through the hollow stem and into the horizontal paddles. It is preferable to inject reagent (permanganate) as a slurry rather than a powder or liquid. This would entail using potassium permanganate powder mixed with enough water to allow the solids to flow but not dissolve completely. Costs for reagents in powder form are generally less than for liquid form. The auger unit is set up to easily accommodate creating and mixing permanganate slurry. Using the powdered form will allow the contractor to mix in just enough water to create a slurry. This should minimize the overall volume to be injected into the subsurface.

The mixing paddles are staggered and can be modified in orientation depending upon site-specific conditions. The standard length of the mixing/paddle portion of the auger unit is typically 8 to 10 feet. Due to the shallow depth of impacts, Raito indicated that the mixing zone could be extended to 15 to 18 feet by adding additional paddles to the drill string. Raito also indicated that soil mixing is primarily horizontal, and the soil column is not mixed vertically. Within the FDDA, the augers would be advanced to a depth of approximately 18 feet BGS. The estimated volume of saturated zone soils that would be treated via auger mixing is 9,500 yds³. Figure 13 illustrates the potential auger auger mixing locations and estimates that up to 425 boring will be required to treat the area (assuming no overlap of auger runs; Figure 13).

Reagent mixing does not occur within the bottom solid portion of the auger. Typical "augering" procedure is to overdrill auger boreholes to make sure mixing occurs at desired final depth;

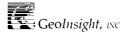


because of concerns regarding creating a vertical migration pathway, this approach can not be employed within the FDDA. For the FDDA, methods will be employed to ensure that the lower portion of the auger does not penetrate the silt unit and extend into the underlying soils. Therefore, the solid auger portion of the unit may need to be modified to reduce its length.

Augering technology has typically been employed to create cement/soil slurries. Unit operating specifications are typically based upon a feed and volume rate that is based upon the desired strength of the mixed soil (i.e., a physical parameter). For cement, Raito indicated that mixing is conducted very quickly, approximately 15 minutes per pass. However, the amount of mixing required to distribute permanganate slurry into soil to result in effective treatment is not known. Augering technology has not been used to introduce reagents/oxidants into soils to remediate VOC impacted media. The technology developed for mixing large volume of additive (fixer/cement), typically 300 lbs per cubic yard. Preliminary calculations of the volumes of permanganate that would be mixed into soil for the FDDA may be far less (10 to 20 lbs/cubic yard).

For the FDDA area, success of the technology will depend upon effective mixing of permanganate with soil, and ability to confirm that adequate mixing has occurred. The auger unit is configured so that the volume of material added during each individual auger "run" is monitored and recorded using a computer based system. This system will be used to monitor and modify the volume of permanganate slurry is introduced during each auger run.

Confirmatory soil sampling will be necessary during treatment to evaluate remedial goals. These samples will have to be collected with another piece of equipment (i.e., the auger unit is not set up to provide representative samples of auger run materials). Raito indicated that these types of samples are most commonly collected using geoprobe or standard drilling rigs. GeoInsight anticipates collecting soil and ground water samples with a geoprobe and utilizing a field gas chromatograph (GC) to analyze soil and ground water during the implementation of the soil mixing technology. Selected samples analyzed by field GC will be submitted for laboratory confirmation.



Based upon preliminary discussions with contractors, the duration of activities associated with completing auger mixing within the FDDA, including mobilization, treatment, and demobilization, is estimated to be approximately three to four months.

Remedial Alternative 2B: Sodium Permanganate Injection.

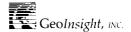
This remedial alternative includes the installation of a chemical oxidant delivery system within the FDDA and the delivery of oxidant solution to saturated zone soils. For Remedial Alternative 2B, the delivery system includes a network of injection wells installed within the general footprint of TCE impacts and screened within the silt layer (at depths ranging from 5 to 18 feet BGS).

Sodium permanganate will be added to each of the injection wells and allowed to migrate into the impacted areas under natural conditions by advection, dispersion, and diffusion. The strategy for this technology is to intercept as many higher permeability lenses as possible to distribute permanganate into the likely pathway of DNAPL and dissolved phase migration. For this remedial alternative, the injection system uses vertical injection wells in the silt unit and shallow trenches in the upper sand unit. The shallow trenches are anticipated to allow for saturation of the upper sand to remediate the zone of initial impacts (i.e. surface release area) and the upper sand silt interface (Figures 9 and 10).

Permanganate associated with this remedial alternative will be delivered to the Olympia Property in liquid form (sodium permanganate solution) and injected manually to minimize on site mixing costs. The remedial alternative will be designed so that multiple applications of oxidant can be performed over time.

Remedial Alternative 2C: Sodium Permanganate Injection with Recirculation.

This remedial alternative is a modification of Remedial Alternative 2B. The oxidant delivery system associated with this alternative includes a subsurface recirculation system to influence hydraulic gradients within the FDDA and enhance the migration and distribution of permanganate into the silt unit.



The remedial alternative will use an injection well delivery system described for Remedial Alternative 2B. In addition, extraction wells will be placed within the FDDA. Water extracted from these wells will be stored temporarily within a holding tank for reinjection upgradient within the FDDA using the existing network of injection wells. Consequently, this method will require costs associated maintenance of the pump systems and above ground handling of water.

Permanganate associated with this remedial alternative will be delivered to the Olympia Property in liquid form and injected manually and mechanically via the recirculation system. The remedial alternative will be designed so that multiple applications of oxidant can be performed over time.

Remedial Alternative 2D: Sodium Permanganate with Sheet Pile Containment.

This remedial technology is the same as Remedial Alternative 2B with the exception that a sheet pile wall is installed around the perimeter of the FDDA. The sheet pile wall limits the hydraulic connection of the impacted portion of the FDDA to adjacent non-impacted areas and provides containment of the oxidant solution. Containment of the oxidant solution is more crucial in the upper sand unit that exhibits high hydraulic conductivities and consists primarily of sandy materials. Use of the sheet pile wall provides more confidence that permanganate will not migrate to areas that do not require treatment.

The sheet pile wall will be installed to a depth of approximately 20 feet BGS along a rectangular perimeter measuring approximately 160 feet by 80 feet around the approximate perimeter of the TCE-impacted area. In addition to providing containment of the oxidant solution, the sheet pile will limit the potential migration of ground water and possible leakage from the nearby sewer lines into the area of treatment (sewer leachate is expected to be anaerobic that could potentially consume large volumes of permanganate). The sheet pile wall will also prevent the migration of the dissolved TCE plume into the central portion of the Aberjona River aquifer.

The oxidant delivery system installed within the footprint of the sheet pile wall will consist of a network of injection wells and shallow trenches. The proposed layout for injection wells and trenches is illustrated on Figures 10 and 11. Permanganate will be delivered to the Olympia



Property in liquid form and injected manually. The remedial alternative will be designed so that multiple applications of oxidant can be performed over time.

Remedial Alternative 2E: Sodium Permanganate Injection with Recirculation and Sheet Pile Containment.

This remedial alternative is a modification of Remedial Alternative 2C. The alternative is the same as that described for 2C with the addition of a sheet pile wall around the perimeter of the FDDA. The sheet pile wall will be installed to a depth of 20 feet. The installation of the sheet pile wall is expected to increase the efficiency of the recirculation system by limiting the migration of ground water into the FDDA from non-impacted adjacent areas.

5.9.3 Combined Technology Alternatives: Soil Excavation and Chemical Oxidation

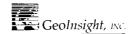
Remedial Alternative 3A: Soil Excavation, Ex-Situ Treatment with Permanganate

This alternative is similar to Alternative 1B, except that granular potassium permanganate is
mixed with excavated soil and returned to the excavation rather than stabilization of soil. This
technology requires shoring for large-scale excavation. Due to site space limitations, large-scale
excavation would be conducted in stages. Dewatering and treatment of ground water would be
required during excavation activities and anticipated to require longer time periods of dewatering
while on-site treatment is conducted.

Remedial Alternative 3B: Targeted Soil Excavation, followed by Permanganate Injection.

This remedial alternative includes the limited excavation and off-site disposal of saturated zone soil from a portion of the FDDA (consistent with the methods described for Remedial Alternative 1A), and treatment of the remaining portion of the FDDA by chemical oxidant injection via wells without a perimeter sheet pile wall (as described in Alternative 2B).

This remedial alternative assumed that approximately one quarter of the impacted area (2,375 cubic yards) would be excavated and disposed off-site. The area to be excavated will coincide with the area of greatest subsurface TCE impacts.



The general approach, methods, and conditions associated with this remedial alternative are consistent with those described for Remedial Alternatives 1A and 2B.

Remedial Alternatives 3C and 3D: Targeted Soil Mixing, followed by Permanganate Injection. These remedial alternatives include treating a portion of the impacted soil area in-situ via mixing and permanganate injection with large-diameter augers and treating the remaining portions of the FDDA by chemical oxidant injection via wells without a perimeter sheet pile wall (as described in Alternative 2B).

This combined approach included two alternatives. Alternative 3C assumed that approximately half of the impacted area (4,750 cubic yards) would be treated via large-diameter augers. Alternative 3D assumed that approximately one quarter of the impacted area (2,375 cubic yards) would be treated via large-diameter augers.

The general approach, methods, and conditions associated with this remedial alternative are consistent with those described for Remedial Alternatives 2A and 2B.

5.9.4 Bio Augmentation

Remedial Alternative 4A: Enhanced Bioremediation.

This remedial alternative includes enhancing natural biodegradation of VOCs by injection of a food source (electron donor) and, if necessary, bacterial culture to the subsurface. To assure the complete degradation of TCE and PCE into ethene gas, the remedial alternative included costs for injection of a bacterial culture containing the organism *Dehalococcoides ethenogenes* (a bacteria that is known to readily degrade vinyl chloride). A 4X safety factor was included in the cost estimated to account for uncertainty of complete degradation of TCE and PCE.

Similar to the chemical oxidation remedial alternative, this alternative includes the installation of a food source and bacterial culture delivery system within the FDDA. For this evaluation, it was



assumed that the delivery system would include a network of injection wells installed within the general footprint of TCE impacts and screened within the silt layer (at depths ranging from 5 to 16 feet BGS). The layout of injection wells would be similar to that shown on Figure 10. Costs for the alternative were developed based upon sodium lactate solution as the electron donor. The cost estimate includes 30 injection events.

The system delivery system would be operated manually and for costing purposes included multiple injections of electron donor and bacterial culture.

5.10 COST ESTIMATES

A general summary of the remedial alternatives is presented in Table 11. The table includes a summary of the primary advantages and disadvantages of each remedial alternative relative to conditions at the Olympia Property and the FDDA.

Cost estimates were prepared for each alternative using basic assumptions regarding the size of the area to be remediated, equipment required for on-site activities, and the duration of remedial tasks. Estimates were obtained from contractors for off-site soil transportation and disposal, sheet piling, shoring, well installation, soil stabilization, and earth auger mixing. In addition, material costs were obtained from suppliers for oxidants, bioremediation solutions, laboratory analyses, and potential above ground system components. Several components of each of the cost estimates were kept consistent between alternatives to maintain consistency between options. Total remedial cost estimates for the alternatives are presented in Table 11. Detailed costs for the remedial alternatives are summarized in tables included in Appendix I. The following information summarizes how components of each alternative were estimated and compared relative to other alternatives.

Sheet pile installation serves different purposes for two approaches to remediation. For excavation alternatives, such as 1A, 1B, 3A, and 3B, sheet pile is primarily for shoring sidewalls during excavation and does not require water tight sealing. For these alternatives, the sheet pile estimate was for installation of a wall that is 800 feet in length installed to 15 feet deep. The



long length of proposed sheet pile wall would be installed to create several work cells by partitioning off several excavation areas. This will minimize dewatering activities to smaller, localized areas. GeoInsight anticipates that sheet pile installed prior to excavation activities would be removed at the end of the project.

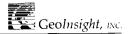
For permanganate injection alternatives, the estimate for the sheet pile wall includes installation of a wall that is approximately 600 feet long and 20 feet deep, as presented in alternatives 2D and 2E. The cost estimate includes sealing joints between sheet pile pieces. The proposed depth is greater to contain migration of dissolved constituents and permanganate. GeoInsight anticipates that sheet pile installed to contain the FDDA area would not be removed.

For the soil auger mixing alternative, a cement wall is proposed to surround the area. The cement wall would be installed prior to soil mixing activities using the same equipment used to mix the permanganate into the soil. The cement wall would consist of a bentonite cement mixture and would become a permanent feature of the FDDA.

As discussed in Section 5.9.2, the safety factors for the amount of permanganate may be reduced when other methods are used to contain or recover permanganate. Upper end costs for permanganate for the injection alternatives (2B, 2C, 2D, and 2E) reflect safety factors suggested by the supplier. However, GeoInsight anticipates that the overall volume of permanganate may be reduced by employing methods of containment and recovery, as proposed in alternatives 2C (recirculation), 2D (sheet pile wall), and 2E (combination of sheet pile and recirculation). GeoInsight believes that installation of a sheet pile wall (sealed at the joints), at an approximate expense of \$110,000, will decrease the amount of permanganate (and associated injection event costs) that could be potentially lost from the upper sand unit or through higher conductivity lenses. Therefore, we have presented a range of potential costs associated with the injection alternatives using different safety factors. All of the injection alternatives propose to inject limited amounts of permanganate, monitor between injection events, and cease injections when the remedial goals have been achieved.



Costs for monitoring each remediation alternative were kept consistent for each alternative by assuming the installation of 15 monitoring well clusters. Each cluster will consist of three one inch diameter piezometers wells screened in shallow, intermediate, and deeper portions of the FDDA. These wells will be used to monitor hydraulic gradients (vertical and horizontal) and collect ground water samples from multiple depths. EPA has indicated that they will require monitoring for at least three years after implementation of the remedial alternative. Therefore, each cost estimate includes three years of post-remedial action ground water monitoring.



6.0 SELECTION OF REMEDIAL ALTERNATIVE

6.1 OVERVIEW

The Order indicated that the Work Plan specified in Section D of the SOW focus upon developing a plan to address TCE-impacted soils in the FDDA. These requirements were in part, based upon a review of the results of initial soil sampling activities and analyses completed by TRC that suggested elevated concentrations of TCE were present in saturated zone soils within the FDDA. In addition to an evaluation of the results of historical characterization activities, focused field investigation activities were completed to better define the nature and extent of TCE within soil and ground water within the FDDA. The results of these investigation activities indicated that TCE within the FDDA is present primarily within the silt unit at depths of 6 to 18 feet BGS. In addition, TCE is present as a dissolved phase in ground water, as an adsorbed phase to soil particles, and as a separate phase (i.e., DNAPL ganglia).

Consequently, the selected remedial alternative focuses upon addressing soil, ground water, and DNAPL impacts within the FDDA. The selected remedy will be used to treat the areas where residuals sources (i.e., ganglia and absorbed-phase TCE) for continued ground water impacts are greatest. Upon completion of remedial actions within the FDDA, areas of significantly lower VOC concentrations (i.e., the fringes of the FDDA and areas within the Aberjona River Valley aquifer to the south and southeast) are expected to attenuate in the absence of an on-going source.

As discussed in Section 4, response actions associated with the FDDA will focus upon reducing dissolved TCE (and associated breakdown products) within the FDDA to concentrations below the applicable drinking water standards.

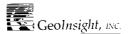
General conditions that are relevant to evaluating remedial options to address dissolved phase TCE within the FDDA and the Olympia Property include:



- TCE impacts are typically shallow, and appear to be greatest from a depth of 5 to 18 feet BGS within the silt unit;
- ground water concentrations suggest that DNAPL ganglia may be present in pore spaces;
- soils within the silt unit are characterized by low organic carbon content;
- the rate of ground water flow through the silt unit appears to be low (i.e., tenths of feet per day);
- the depth to ground water within the FDDA is very shallow, typically within several feet of the ground surface;
- conditions within the FDDA do not appear to have changed appreciably since the initial characterization activities were completed in the late 1980s;
- the thickness of the silt unit decreases to the east and south (in the direction of the sand and gravel units that form the central Aberjona River valley);
- ground water flow in the vicinity of the Olympia Property is predominantly through the sand and gravel units that underlie the silt unit, and within the sand layer that is located within the FDDA from the ground surface to a depth of approximately 5 feet; and
- ground water impacts within the central river valley just southeast of the FDDA are typically low (tens to low hundreds of ug/l) and are present within the middle portion of the aquifer.

City of Woburn municipal supply wells G and H were shut down in 1979 and were physically abandoned in the mid-1980s. Ground water within the central Aberjona River valley is not currently used as a source of drinking water. The area within and surrounding the Wells G & H Superfund site are served by municipal water.

The Olympia Property consists of undeveloped woodland and wetland areas associated with the west bank of the Aberjona River. Properties to the north, south, and southeast of the Olympia Property are occupied by undeveloped woodland and wetlands associated with the Aberjona



River and the Wildwood Conservation Trust Area. The FDDA is border to the west by the Boston and Maine railway easement and commercial properties along Wildwood Avenue. Access to the FDDA is limited and controlled primarily by the railway easement and the presence of wetland areas. Vehicle access to the FDDA is only possible via a dirt pathway from the south along the MWRA sewer easement. Access to this dirt path is controlled via fences and a series of locked gates located on the Wildwood Conservation Trust property.

Information obtained to date indicates that some time prior to 1978, approximately 12 drums were abandoned within the FDDA portion of the Olympia Property. Materials released from these drums appear to have included chlorinated solvents, predominantly TCE. The TCE appears to have migrated through the surficial layer of sand into the underlying silt unit. Based upon local hydraulic conditions, the silt unit does not appear to have a significant hydraulic connection to the underlying more permeable aquifer soils and has not been subject to significant flushing. Consequently, the TCE has been subjected to limited attenuation mechanisms over time. Although recent testing indicates that the TCE is undergoing localized biodegradation via reductive dehalogenation, the rate of degradation appears to be low. Hydraulic and environmental quality conditions within the FDDA, including the limited mobility of TCE, are not expected to change in the foreseeable future.

Based upon the results of the evaluation described above, review of potential remedial technologies focused upon those alternatives that would most effectively address the presence of TCE within the FDDA. The advantages and disadvantages of the proposed remedial technologies are summarized in Table 11.

6.2 SELECTED REMEDIAL ALTERNATIVE

In-situ chemical oxidation (via permanganate) is the selected remedial alternative for the FDDA portion of the Olympia Property. Of the chemical oxidation remedies, Remedial Alternative 2D was selected for implementation within the FDDA. The strategy for this technology is to intercept as many higher permeability lenses as possible to distribute permanganate into the likely pathway of DNAPL and dissolved phase migration. For this remedial alternative, the

injection system was designed based primarily upon vertical injection wells in the silt unit and shallow trenches in the upper sand unit. The shallow trenches are anticipated to allow for saturation of the upper sand to remediate the zone of initial impacts (i.e. surface release area) and the upper sand silt interface. The major components of Remedial Alternative 2D include:

- a sheet pile wall installed to a depth of approximately 20 feet around the perimeter of the FDDA (an area 160 feet long and 80 feet wide);
- delivery of permanganate to the upper sand unit via shallow trenches;
- delivery of permanganate to the silt unit via injection wells screened within the silt unit;
- multiple applications of oxidant via gravity drainage; and
- monitoring of ground water conditions within the FDDA via a network of nested monitoring wells.

Conditions associated with Remedial Alternative 2D that were considered favorable with regard to conditions within the FDDA include:

- use of the sheet pile wall to contain impacted ground water, thereby limiting lateral migration to the central valley aquifer, and ensuring that oxidant remains within the area of remedial focus;
- ease of installation of the oxidant delivery system within the FDDA, and if necessary, the
 ability to subsequently modify the system quickly and with minimal disruption to the
 existing delivery system;
- availability of remedial system components and materials;
- moderate cost and reasonable time frame for implementation;
- limited disruption to conditions at the Olympia Property and ability to implement the remedy without heavy construction equipment or permanent structures; and



• limited potential for disruption and concerns regarding possible impacts to the MWRA and City of Woburn sewer lines.

6.2.1 Precautions and Monitoring Associated with Remedy Implementation

Certain precautions and handling requirements will be implemented as part of the chemical oxidation remedial alternative. Sodium permanganate is a strong oxidizer and safe handling guidelines will be included in the Site Specific Health and Safety Plan.

GeoInsight will implement permanganate injections within the boundaries of a driven sheet pile cell. Monitoring will be conducted during implementation of the remedy to evaluate:

- migration of permanganate solution outside the sheet piled area;
- significant changes in the oxidation state of the central valley aquifer;
- generation of daughter products of the breakdown of PCE and TCE; and
- changes in concentrations of sodium, chloride, and manganese in the aquifer and wetland.

Based upon the permanganate demand study, peat samples consumed permanganate at a far greater rate than the low organic carbon soils in the silt unit. Therefore, although permanganate is not expected to migrate into the wetland, unanticipated releases of permanganate to the wetland would be buffered by the presence of the high organic carbon content organic soils associated with the wetland areas and Aberjona River floodplain.

Prior to implementation of a remedial alternative, base line sampling will be conducted to evaluate background concentrations of manganese, sodium, and chloride and physical parameter field data including DO, ORP, conductivity, and pH, to characterize the geochemical conditions of the area outside the FDDA and within the adjacent central river valley aquifer. Within the



FDDA, delivery of the oxidant may result in the precipitation of dissolved metals that are present in ground water within the silt unit. Similar impacts are not expected within the central river valley aquifer downgradient of the FDDA.

Based upon experience at other sites where permanganate was used to treat dissolved chlorinated VOCs, it is not anticipated that adverse daughter products or significant changes in ground water geochemistry will occur at the Olympia Property.

6.3 REMEDIAL EFFECTIVENESS MONITORING

GeoInsight proposes to install 15 piezometer well clusters screened in shallow, intermediate and deeper portions of the FDDA to monitoring hydraulic characteristic inside and outside of the treatment area. Five of theses clusters well be distributed in a profile downgradient of the FDDA (compliance point monitoring wells) to monitor ground water quality leaving the treatment area. The locations of proposed additional wells are illustrated on Figure 12.

The effectiveness of remedial actions within the FDDA will be evaluated by monitoring ground water quality. Ground water samples will be collected from existing and new monitoring wells. Samples will be obtained and analyzed during and after remedial operations are completed. The sampling program will include ground water samples collected from multiple locations and depths that are representative of the different stratigraphic units within the FDDA. Confirmatory ground water monitoring will be performed over several events and time periods. Confirmatory ground water samples will be analyzed for VOCs using EPA Method 8260B (with low detection limits specified). Field measurements of standard field parameters will also be obtained to document the geochemical conditions of ground water over time.



6.4 REMEDIATION WASTE CHARACTERIZATION

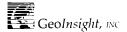
Implementation of Remedial Alternative 2D is not expected to generate significant quantities of remedial waste material. Depending upon the final configuration and design, small quantities (i.e., several cubic yards) of soil may be generated during the installation of the oxidant delivery system. In June 2002, TRC collected soil samples from the FDDA for disposal characterization. A soil sample was collected from 11 to 15 feet BGS in boring 135N35E, in an area that contained elevated VOC concentrations. The sample was analyzed for toxicity characteristic leaching potential (TCLP) herbicides, TCLP pesticides, TCLP semi-volatile organic compounds (SVOCs), TCLP VOCs, TCLP metals, reactivity, pH, and flashpoint. Results of the TCLP analyses indicated that the material did not exhibit characteristics of a hazardous waste. Therefore, subsurface soil generated during the installation of the oxidant delivery system will be placed into containers and treated with permanganate on site.

Purge water generated during ground water monitoring activities will be temporarily stored in closed 55-gallon drums, treated with permanganate, and returned to the ground surface within the FDDA. Quantities of purge water generated during the project are expected to be small (i.e., several hundred gallons).

6.5 PERMITS

Implementation of Remedial Alternative 2D will not be dependent upon obtaining permits.

Recent focused field investigation activities required that an application be filed for an 8M Permit from the MWRA to complete drilling and well installation activities in the vicinity of the sewer line. The permit was submitted on April 11, 2003. On June 6, 2003, GeoInsight received the MWRA 8M permit to conduct investigation activities in the vicinity of the sewer line. A similar permit will be obtained from the MWRA to conduct remedial activities in the vicinity of the sewer easement, including the installation of the sheet pile wall. Based upon the permit obtained in June 2003, we expect that the process time to obtain an additional permit to conduct



the remedial activities will be approximately two to three months from the date that the permit application is filed.

The City of Woburn Engineering Department was also contacted to evaluate whether a similar permit was required to conduct work in the vicinity of the City's sewer. Based upon initial discussions with Brett Gonsalves of the Woburn Engineering Department, it does not appear that a permit will be necessary to work in the vicinity of the sewer line. The Superintendent of the Woburn Department of Public Works was also contacted to discuss the proposed remedial activities and confirmed the information provided by Mr. Gonsalves.

In addition to the MWRA permit, a DigSafe permit for utility clearance will be required for intrusive activities performed within the FDDA. DigSafe clearance typically requires a three-day wait period before field activities are performed. A request for a permit has not yet been made because the effective period for a permit is only 30 days. However, previous field activities have documented the approximate location of buried utilities within the Olympia Property and new utility lines are not expected to be installed in the area in the foreseeable future (i.e., the expected duration of the remedial action).

Field activities associated with implementing the remedial alternative will not be conducted within wetlands. However, certain activities will be conducted within 100 feet of the wetlands located to the east and south of the FDDA. Consistent with the general provisions of the Clean Water Act and the Wetlands Protection Act, measures will be employed to limit surface water runoff and sedimentation within wetland area adjacent to the FDDA. These measures will include, as appropriate, the installation and maintenance of silt fences/curtains and the covering and securing of stockpiled materials.

Access to the FDDA is from a dirt path that enters the Olympia Property from the Wildwood Conservation Trust property to the south. Olympia Nominee Trust has a formal agreement with the Wildwood Conservation Trust that provides access to the dirt path. This agreement will be updated to facilitate implementation of the remedial alternative. Equipment used and activities performed to implement the remedial alternative are similar to those that were recently



conducted in the FDDA area by TRC and GeoInsight, and as such, are not expected to disrupt activities at the Wildwood Conservation Trust property.



7.0 REMEDY IMPLEMENTATION

The selected remedy includes the creation of a sheet pile wall that surrounds the impacted area to a depth of 20 feet. Sodium permanganate solution will be distributed by gravity drainage and diffusion. Distribution of permanganate into the shallow portions of the FDDA will be through shallow trenches. Injection into the trenches is anticipated to saturate the upper sand unit and flood the sand-silt interface. Distribution of permanganate into the deeper portions of the FDDA will be through deeper injection wells screened only within the silt unit. The deeper injection wells will likely intersect areas of higher permeability, such as sand lenses. Injection of permanganate into deeper portions of the aquifer will be conducted in a series of injections, spread over at least 6 months time.

Conditions associated with implementation of the remedy will be monitored inside and outside of the treatment cell. Rebound will be monitored at each injection point to evaluate the timing of subsequent injections. Once the treatment cell is constructed, permanganate can continue to be injected until remedial goals are achieved.

7.1 SITE PREPARATION

Prior to sheet pile installation and drilling activities, the site will be prepared. Existing wells will be inspected and protected by adding new standpipes or by cutting the wells flush with grade and adding a concrete pad at the surface. These activities are proposed to allow for better vehicular access and minimize damage to existing wells. Other site modifications will include tree clearing and adding a chain link fence around delivery system area. Staging and work areas will be located north and upgradient of the injection area.

7.2 SHEET PILE INSTALLATION

The location of the sheet pile is limited by the location of the underground sewer lines and the nearby wetlands. GeoInsight proposed to install the western edge of the sheet pile wall 10 feet



east of the MWRA sewer line. The northern sheet pile wall will be installed near GEO-SB-103. The eastern sheet pile wall will be installed along the existing natural berm. The southern sheet pile wall will be installed just downgradient of well OL-003. The location of the southern boundary wall is limited by the close proximity of the Aberjona wetlands. The sheet pile was will be sealed at the joints during installation. The approximate dimensions of the sheet pile wall, installed to include the most impacted area of the FDDA, will be 80 by 160 feet. The sheet pile configuration will be evaluated during the pre-design phase to evaluate if the larger area will be sectioned off into smaller treatment areas. Sheet pile will be installed from ground surface to a depth of approximately 20 feet.

7.3 INJECTION SYSTEM

Permanganate will be injected under gravity drainage conditions (very low flow). The upper sand will be saturated with permanganate. Permanganate injection into deeper portions of the silt unit will be through injections wells screened within the silt unit. The injection wells will be grout sealed to prevent permanganate from following the well casing upward to the more permeable sand unit. A constant head level of permanganate, contained within the well casing set above grade, will slowly disperse permanganate into the silt unit. Injection wells that cross higher permeability units will drain more quickly.

The permanganate delivery system will include the following:

- liquid permanganate will be stored in large storage tank, with secondary containment. GeoInsight anticipates that 40% permanganate solution will be injected into the formation;
- permanganate solution will be injected into six shallow trenches and approximately fortyfive (45) 4-inch diameter deep injection wells installed in an offset grid pattern approximately 15 feet apart;
- deep injection wells will be screened within the silt unit and sealed with grout. The solid casing will be extended approximately 3 feet above grade. The well casing will act as a reservoir of permanganate to create a few feet (5-7') of head pressure on the screen interval of the well;



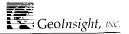
- deep injection well screens will be constructed of 0.05 inch machine slotted well screen The annular space around the well screens will be filled with #2 Morie sand;
- permanganate will enter shallow trenches through a long feed pipe connected to a large holding tank reservoir. Each trench will be controlled by separate gate valves;
- permanganate will be added to each injection well manually using pumps and hoses connected to the main permanganate feed line;
- permanganate storage tank will be located at a higher elevation to utilize gravity flow; and
- flow will be monitored with chemical resistant totalizers.

GeoInsight will evaluate the distribution of permanganate in the first 4 to 6 months of injection. During this time period, GeoInsight will consider the use of recirculation to enhance distribution. For recirculation, a few of the existing injection wells would be concerted to low flow pumping wells. anticipates that once the injections have been initiated

7.4 INJECTION EVENTS

GeoInsight anticipates conducting a series of injection events. The first injection event will include saturation of the upper sand unit through the shallow trenches and addition of permanganate to the injection wells. GeoInsight anticipates that approximately 1,000 gallons of liquid permanganate will be injected into the FDDA during each event. For the first event, the permanganate will be injected into only the shallow trenches to saturate the silt - sand boundary. After the first event each, the injection wells will be used to monitor vertical distribution of permanganate. In subsequent events, GeoInsight anticipates that permanganate will be added to the injection wells only, or to the wells and trenches depending on the results and monitoring of the first injection.

Between injection events, GeoInsight will monitor permanganate levels in each injection well and record the volume that has drained into the silt unit. Head elevation levels will be recorded in monitoring wells inside and outside of the treatment area. Injecting smaller quantities of permanganate in subsequent events will minimize the potential of precipitate clogging and the



formation of DNAPL rinds, if ganglia are present. Between injection events, GeoInsight will collect ground water samples for VOC and metals analysis from up to 10 selected wells.

Once the 2X safety factor volume of permanganate is injected, subsequent injection events will add permanganate to injection wells and trenches on an as-needed basis. GeoInsight anticipates that smaller amounts of permanganate will be added during subsequent events

7.5 MONITORING WELL NETWORK

Monitoring well clusters will be used to monitor vertical gradients, ground water color, ground water quality, and ground water geochemistry. Multi-level clusters will provide data at multiple levels of the FDDA inside and outside of the treatment sheet pile wall. The monitoring system will include the following:

- 15 piezometer well clusters (total) inside and outside the sheet pile wall to monitor ground water quality, water level, and water color;
- clusters will consist of two to three 1-inch diameter geoprobe wells screened in shallow, intermediate, and deeper portions of the FDDA. Cluster depths will be dependent on stratigraphy and location. Prior to installation a geoprobe soil boring will be conducted to evaluate stratigraphy. The deepest monitoring well of the cluster will be installed in this soil boring. Then 1 to 2 additional wells will be installed at shallower portions of the FDDA in adjacent locations by casing driven techniques;
- the locations and number of wells may be amended depending on the location and usefulness of existing wells; and
- additional downgradient wells will be installed as compliance monitoring wells to monitor ground water quality as it exits the FDDA area (see Figure 12).

7.6 MONITORING EVENTS

Two types of monitoring events are proposed, monitoring during remedial implementation and post remedial compliance monitoring. Monitoring during implementation will be conducted once between each injection event. Post remedial compliance monitoring will be conducted



quarterly for three years. Monitoring will include analyses of VOCs, iron, manganese, arsenic, sodium, and chloride.

Between injection events the multi-level well clusters will be gauged and monitored for color. These data will aid in evaluation of vertical and horizontal gradients inside and outside of the sheet pile. Observations of color will help to delineate where the permanganate has migrated.

7.7 PERMANGANATE HANDLING CONTINGENCY PLAN

A contingency plan will be developed to manage accidental permanganate spills and releases during handling. An earthen berm will mark the boundary of the sheet pile wall and contain permanganate in case of large volume spills.



8.0 ODOR AND DUST CONTROL

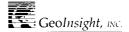
GeoInsight anticipates that possible remedial activities including installation of injection wells or trenches, excavation of impacted soils to install subsurface piping or apertures, and the installation of sheet piles, will not generate excessive dust based upon the limited duration and extent of these soil disturbances and the generally saturated nature of subsurface materials within the FDDA. Control methods (such as soil wetting) will be available and used if the generation of dust occurs during implementation of the selected alternative.



9.0 AIR MONITORING/SAMPLING PLAN

The constituents of concern in the FDDA are VOCs. Therefore, GeoInsight anticipates monitoring ambient air in the work zones periodically throughout each workday as specified in the Site Specific Health and Safety Plan. Because the majority of field activities in the FDDA do not significantly disturb the ground surface (i.e., the installation of injection and monitoring points, shallow trenches, etc.), and VOCs are located at depths greater than 3 feet, the generation of significant VOC vapors and odors is not considered likely. It is important to note that elevated concentrations of VOC vapors and odors were not detected during field activities recently completed in the FDDA under the Order, including during the excavation of shallow saturated zone soils.

During implementation of the selected remedial option and subsequent monitoring activities, a PID equipped with an 11.7-volt lamp will be used to periodically to monitor for the presence of VOCs, which may be encountered near the work areas. If sustained PID readings in the breathing zone exceed 10 ppm, field activities will cease and the work area will be evacuated. The need for additional air monitoring and personal protective equipment (PPE) upgrade will be evaluated in conjunction with GeoInsight's Health and Safety Officer, Site Safety Officer, and USEPA's On-Scene Coordinator.



10.0 RESTORATION PLAN

At completion of remedial implementation, disturbed areas will be graded to the original surface grade. Because work areas are surrounded by a wetland, GeoInsight does not anticipate that hydro-seeding or professional landscaping services will be employed. Native seed will be distributed to the graded areas to inhibit the growth of invasive and exotic species. Natural regrowth of native plants is anticipated in the area.

Piping and system apertures that are located above the ground surface will be removed (i.e., cut just below the ground surface). The network of existing monitoring wells will be evaluated with regard to maintaining a limited network of wells that can be used to monitor general ground water quality and hydraulic conditions within the FDDA and the central Aberjona River valley. Non-essential wells will be abandoned in accordance with USEPA guidelines.

Structures installed along the dirt access road to facilitate access to the FDDA will not be removed.



11.0 LABORATORY

Recent soil and ground water testing was conducted by Groundwater Analytical Inc. (GWA). GWA laboratory is accredited under the National Environmental Laboratory Accreditation Conference (NELAC). A copy of GWA's certification is attached in Appendix J. It is expected that GWA will provide analytical services associated with implementation and monitoring of the selected remedial alternative.

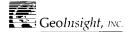
The following table lists the type of analyses conducted for samples collected from the Olympia Property and the EPA method used for the analysis.

COMPLETED ANALYSES:

Analysis	Method
VOCs	EPA Method 8260B (compliance evaluation)
	EPA Method 8021B (periodic monitoring)
Total organic carbon	SM 5310C

PROPOSED ANALYSES:

Analysis	Method
VOCs	EPA Method 8260B (compliance evaluation)
	EPA Method 8021B (periodic monitoring)
Metals (manganese, iron)	EPA Method 6010B
Metals (arsenic)	EPA Method 7000/200
Sodium	EPA Method 7000/200
Chloride	EPA Method 325.2

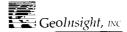


12.0 DISPOSAL FACILITY INFORMATION

Generation of remedial wastes that will require off-site treatment, disposal, or recycling are not anticipated associated with implementation of Remedial Alternative 2D.

Specialty Waste Services Inc. (SWS) has been used to coordinate the characterization and disposal of waste materials generated within the FDDA to date. Depending upon the final oxidant delivery system designed for the FDDA, a limited volume of moderately impacted soil may be generated during the installation of the delivery system. Based upon activities completed at the Olympia Property to date, these soils will likely be disposed off-site as non-hazardous waste.

Soils that are generated during remedial activities and that require off-site disposal will be transported under Hazardous Waste Manifest by a licensed, Department of Transportation (DOT) transporter under contract with SWS.



13.0 PROJECT TIME LINE

The following project timeline was developed to estimate the general time periods associated with implementation of Remedial Alternative 2D (Sodium Permanganate Injection with Sheet Pile). The remedial alternative includes the installation of a shallow sheet pile wall to isolate the area of greatest TCE impacts within the FDDA and the delivery of permanganate to the associated silt unit.

Previous experience at the Olympia Property indicated that an MWRA permit will be required to install the western portion of the sheet pile wall. Based upon the time period to obtain previous MMRA permits at the property, GeoInsight estimates that the permit application will take approximately two to three months to be reviewed and approved by MWRA.

After the MWRA permit is issued, site preparation activities will be initiated. GeoInsight anticipates that the existing bridge will need to be upgraded or replaced to accommodate the sheet pile installation equipment. Bridge enhancements are estimated to require two to three weeks to complete.

The following table indicates implementation activities and the approximate time for each to be conducted. Implementation of the tasks will be dependent upon review and approval of the work plan.



TASK	Estimated Time to complete task
Permits Submit permit application to Massachusetts Water Resources Authority (MWRA) to drive sheet pile, and continue construction activities (anticipated by April 2004).	2-3 months
Site Preparation Bridge Enhancements for Sheet Pile Crane Brush Clearing	1 to 2 months
Sheet Pile Installation	1 month
Injection Well and Trench Installation Trenching Horizontal Wells (5 days) Drilling Vertical Wells (10 days)	1 month
Installation of Liquid Permanganate Delivery System Staging Area for Permanganate Storage	1 month
Up to 20 Injection Events - Dependent on Site Monitoring Includes Site Preparation, Delivery of Reagent Inject 1,000 gallons of NaMnO4 Total volume for 2X Safety Factor (7,400 gallons) Inject 1,000 gallons of NaMnO4	5-6 Months
Total volume for 4X Safety Factor (14,600 gallons)	
Post Remediation Monitoring (quarterly for three years)	1 day per event



14.0 REFERENCES

Draft Technical Memorandum, Phase 1 Pre-Design Investigation, Response Action Contract (RAC), Region 1, Brown & Root Environmental, March 1998.

Data Summary Report for the Former Drum Disposal Area, TRC Environmental Corporation, December 2002.

In Situ Chemical Oxidation Using Potassium Permanganate, September 1999, Innovative Technology Summary Report, DOE/EM-0496.

Geochemical Effects on Metals Following Permanganate Oxidation of DNAPLs, Groundwater, vol. 41, no.4:458-469, Crimi, M.L., Siegrist, R.L.

Organic Carbon Dominated Trichloroethene Sorption in a Clay-Rich Glacial Deposit, Allen-King, R.M., McKay, L.D., Trudell, M.R., January-February 1997, Ground Water, Vol. 35, No. 1, pp. 124 – 130.

TABLE 1A SUMMARY OF GROUND WATER ANALYTICAL DATA - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

			120000	Name (1820)				20004	22116111227122		CONST	TITUENT	(VOCs)	200000000000000000000000000000000000000	Wall 1985	EVA CONTROL			(355)241 m	F-4585,014	talifo iv	EH-124.24
LOCATION ID	Sampling Date	Screen Interval	PCE	TCE	1,1,1-TCA	1,1-DCE	cis.1,2-DCE	Vinyl Chloride	1,1,2- Tricholor- 1,2,2-Trifluorethane	1,1-DCA	1,2-DCA	Chloro- methane	Dichlorodi- fluoromethane	Methylene chloride	Acetone	4-Methyl-2- pentanone	Chloroform	Benzene	Toluene	Ethyl- benzene	Xylenes	MtBE
						100			UPC	RADIEN	T							Title				ELECTION TO
OL-005	12/15/87	3.5-8.5	ND	ND	ND				2	2 (J)				***				ND		ND	ND	***
OL-005	03/19/02	3.5-8.5	<0.100	< 0.100	<10	< 0.100	<2	< 0.100	10 (UJ)	<10	< 0.100	<0.100	<10	4 (UJ)	10 (UJ)	<10	<0.100	< 0.100	<2	<2	<10	3 (J)
OL-005	06/02/03	3.5-8.5'	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<2.5	<10	<5	<0.5	<0.5	<0.5	<0.5		2
MW-12	07/10/02	3.5-13.5	< 0.100	< 0.100	<10	<0.100	<2	<0.100	<10	<10	<0.100	<0.100	<10	<10	<10	<10	<0.100	<0.100	<2	<2	<10	1 (J)
				1.20				FOR	MER DRUM I	DISPOSA	L AREA	(FDDA)		Salma Se							
OL-002	12/15/87	4-9'	41	3,100	ND					ND								ND		ND	170	
OL-002	12/15/87	4-9'	33	3,400	ND					ND				***		***		ND		ND	140	
OL-002	09/16/97	4-9'	8	3,700	1		3	<1		<1				<2			13	<1	<1	7	79	
OL-002	03/20/02	4-9'	<120	7,900	<600	<120	<120	<120	400 (J)	600 (UJ)	<120	<120	<600	200 (UJ)	600 (UJ)	<600	<120	<120	<120	<120	<600	600 (UJ)
OL-002 (Field Dup D02290)	03/20/02	4-9'	<120	8,000	<600	<120	<120	<120	380 (J)	600 (UJ)	<120	<120	<600	240 (UJ)	600 (UJ)	<600	<120	<120	<120	<120	<600	600 (UJ)
OL-002	04/22/03	4-9'	3	91	<1	<1	4	<1		<1	<1	<1	<20	<5	<20	<10	<1	<1	<1	<1	<1	<1
OL-002	06/02/03	4-9'	<5	330	<5	<5	17	<5		<5	<5	<5	<5	<25	<100	<50	<5	<5	<5	<5	<5	<5
OL-2M	07/09/02	21.5-31.5	<0.100	5	<10	< 0.100	<2	< 0.100	<10	<10	<0.100	<0.100	<10	<2	<10	<10	0.0911 (J)	<0.100	<2	<2	<10	<10
OL-2M	06/02/03	21.5-31.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<2.5	<10	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	<0.5
GEO-4	06/24/03	6-16'	<5	340	<5	<5	<5	<5	***	<5	<5	<5	<5	<25	<100	<50	<5	<5	<5	<5	<5	<5
TEST-1	07/09/02	1.8-16.8	14	12,000	<10	<2	15	2	400 (J)	<10	<2	<2	6 (J)	<2	<10	<10	62	<2	1 (J)	24	150	<10
TEST-1 (Field Dup D02947)	07/09/02	1.8-16.8	15	12,000	<10	<2	15	2	410 (J)	<10	<2	<2	6 (J)	2	<10	<10	64	<2	1 (J)	25	160	<10
TEST-1	06/02/03	1.8-16.8	3	1,300	<2.5	<2.5	130	3	170	<2.5	<2.5	<2.5	<2.5	<13	<50	<25	5	<2.5	<2.5	<2.5	<2.5	<2.5
TEST-1	06/24/03	1.8-16.8	<5	400	<5	<5	53	<5		<5	<5	<5	<5	<25	<100	ර	<5	<5	<5	6	5	<5
GEO-5	06/24/03	2-12	280	3,300	<50	<50	<50	<50		<50	<50	<50	<50	<250	<1,000	<500	<50	<50	<50	<50	<50	<50
MW-13	07/09/02	7-17'	410	780	<10	<2	1,500	<2	150	<10	<2	<2	<10	<10	<10	<10	<2	<2	<2	12	6 (J)	<10
MW-13	04/22/03	7-17'	650	280	<10	<10	780	<10		<10	<10	<10	<10	<50	<200	<100	<10	<10	<10	<10	<10	<10
MW-13	06/02/03	7-17'	430	250	<25	<25	1,300	<25		<25	<25	<25	<25	<130	<500	<250	<25	<25	<25	<25	<25	<25
GEO-7	06/24/03	6-16'	2	8	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<2.5	<10	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
OL-003	12/15/87	4-9'	45	180	ND	***	23	ND	See .	ND	***		***	ND	***	***	ND	ND	ND	ND	ND	
OL-003	09/16/97	4-9'	5	94	<1		280	95	-	<1				<2		-	4	<1	<1	46	300	
OL-003	03/18/02	4-9'	0.508 (J)	13	<10	< 0.100	57	16	27 (J)	<10	< 0.100	< 0.100	<10	<2	<10	<10	0.796 (J)	<0.100	<2	3	4 (J)	1 (J)
OL-003	06/02/03	4-9'	0.8	2	<0.5	<0.5	11	7		<0.5	<0.5	<0.5	<0.5	<2.5	<10	<5	<0.5	<0.5	<0.5	3	9	<0.5
OL-3M	07/10/02	21.5-31.5	<0.100	0.191	<10	<0.100	<2	<0.100	<10	<10	<0.100	<0.100	<10	<2	<10	<10	<0.100	< 0.100	<2	<2	<10	<10
OL-3M	06/02/03	21.5-31.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<2.5	<10	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GEO-3	06/24/03	6-16'	<0.5	4	<0.5	<0.5	49	35	***	<0.5	<0.5	<0.5	<0.5	<2.5	<10	<5	<0.5	<0.5	<0.5	14	65	<0.5
MW-14S	07/10/02	5-15'	25	180	<10	<2	670	190	31	<10	<2	<2	<10	<2	<10	<10	<2	<2	<2	2	<10	<10
MW-14S	04/22/03	5-15	1	6	<1	<1	61	19		<1	<1	<1	<1	<5	<20	<10	<1	<1	<1	<10	<10	<1
MW-14S	06/02/03	5-15'	2	15	<1	<1	62	16		<1	<1	<1	<l< td=""><td><5</td><td><20</td><td><10</td><td><1</td><td><1</td><td><1</td><td><1</td><td><1</td><td><1</td></l<>	<5	<20	<10	<1	<1	<1	<1	<1	<1
MW-014M	07/10/02	20-30'	<0.100	<0.100	<10	<0.100	<2	<0.100	<10	<10	<0.100	<0.100	<10	<10	<10	<10	<0.100	<0.100	<2	<2	<10	<10
GROUND WATER STA	NDARDS	To Artist in	5	5	200	7	70	2	NA NA	70	5	NA	NA	5	3,000	- NA	5	5	1,000	700	10,000	70

TABLE 1A SUMMARY OF GROUND WATER ANALYTICAL DATA - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

										esception of	CONS	TITUENT	(VOCs)		S IN GREET RES	1000		***	de Arrivo	KASIH SI	cho con cons	100
LOCATION ID	Sampling Date	Screen Interval	PCE	TCE	1,1,1-TCA	1,1-DCE	cis,1,2-DCE	Vinyl Chloride	1,1,2- Tricholor- 1,2,2-Trifhiorethane	1,1-DCA	1,2-DCA	Chloro- methane	Dichlorodi- fluoromethane	Methylene chloride	Acetone	4-Methyl-2- pentanone	Chloroform	Benzene	Toluene	Ethyl- benzene	Xylenes	MtBE
								D	OWNGRADII	ENT/SID	E-GRADI	ENT										
MW-011S	04/26/02	4-14'	<0.100	0.13	<10	< 0.100	<2	0.264	<10	<10	<0.100	< 0.100	<10	2 (UJ)	<10	<10	<0.100	<0.100	<2	<2	10 (UJ)	2 (J)
MW-011M	04/26/02	40-50'	7	120	<10	2	17	<2	250	<10	<2	<0.100	<10	2 (UJ)	<10	<10	<2	<2	<2	<2	10 (UJ)	1 (J)
MW-011D	04/26/02	81-91'	<0.100	<0.100	<10	< 0.100	<2	< 0.100	<10	<10	< 0.100	< 0.100	<10	2 (UJ)	<10	<10	< 0.100	<0.100	<2	<2	10 (UJ)	<10
MW-010S	04/22/02	4-14'	< 0.100	<0.100	<10	<0.100	<2	<0.100	<10	<10	<0.100	<0.100	<10	2 (UJ)	<10	<10	<0.100	<0.100	<2	<2	10 (UJ)	3 (J)
MW-010M	04/25/02	40-50	< 0.100	0.0779(J)	<10	< 0.100	<2	<0.100	<10	<10	<0.100	<0.100	<10	2 (UJ)	<10	<10	< 0.100	<0.100	<2	<2	10 (UJ)	<10
MW-010D	04/25/02	88.5-98.5	0.174	1.4	<10	< 0.100	<2	< 0.100	<10	<10	<0.100	<0.100	<10	2 (UJ)	<10	<10	<0.100	0.316	<2	<2	10 (UJ)	<10
GEO-6 (GEO-SB-90)	06/24/03	11-16'	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<2.5	<10	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
				100					DEEP OVE	RBURDE	N WELI	S										331
GEO-1	09/21/99	90-100'	<1.5	2.5	<1	<1.5	<1	<2		<1.5	<1.5	<10	<10	12	<10	<10	<1.5	<1	1.6	<1	<1	***
GEO-1	03/18/02	90-100'	0.104	0.244	<10	<0.100	<2	< 0.100	10 (UJ)	<10	<0.100	<0.100	<10	<2	10 (UJ)	<10	< 0.100	< 0.100	<2	<2	<10	<10
GEO-2	09/21/99	95-105	<1.5	1.6	<1	<1.5	<1	<2		<1.5	<1.5	<10	<10	8.8	<10	<10	<1.5	<1	<1.5	<1	<1	***
GEO-2	03/15/02	95-105'	<0.100	0.175	<10	<0.100	<2	<0.100	<10	<10	<0.100	<0.100	<10	2	4 (J)	<10	<0.100	<0.100	<2	<2	<10	<10
GROUND WATER ST	ANDARDS		5	5	200	7	70	2	NA	70	5	NA	NA	5	3,000	NA.	5	5	1,000	700	10,000	70

- 1. All values in ug/l (micrograms per liter); parts per billion.
- 2. Bold exceeds laboratory detection limits.
- 3. Shaded concentrations exceed applicable Ground Water Standard.
- 4. Ground Water Standards are ROD ICLs or MCP Method 1/GW-1 Risk Standards.
- 5. (J) = estimated concentration.
- 6. (UJ) = estimated non-detect.
- 7. DCE = Dichloroethene
- 8. DCA = Dichloroethane
- 9. TCE = Trichloroethene
- 10. TCA ≈ Trichloroethane
- 11. PCE = Tetrachloroethene
- 12. MTBE = Methyl tert butyl ether
- 13. ND = Not Detected: detection limit unknown.
- 14. 1,2-Dichlorobenzene detected in samples OL-2 on 9/16/97 at 2 ug/l, OL-3 on 9/16/97 at 8 ug/l, OL-003 on 6/2/03 at 0.7 ug/l, and GEO-3 on 6/24/03 at 7 ug/l.
- 15. 1,2,4-Trimethlybenzene detected in OL-003 on 6/2/03 at 0.8 ug/l and in GEO-4 on 6/24/03 at 14 ug/l.
- 16. 1,1,2-Trichloroethane detected in OL-002 on 6/2/03 at 150 ug/l.
- 17. Bromodichloromethane detected in Test-1 on 6/2/03 at 14 ug/l.
- 18. Trans-1-2 Dichloroethene detected in GEO-3 on 6/24/03 at 0.7 ug/l.
- 19. Isopropylbenzene detected in GEO-3 on 6/24/03 at 3 ug/l.
- 20. N-Butylbenzene detected in GEO-3 on 6/24/03 at 2 ug/l.
- 21. N-Propylbenzene detected in GEO-3 on 6/24/03 at 3 ug/l.
- 22. 1,3,5-Trimethylbenzene detected in GEO-3 on 6/24/03 at 5 ug/l.

TABLE 1B SUMMARY OF GEOPROBE GROUND WATER ANALYTICAL DATA - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

							(N N N N N N N N N N				CONSTI	TUENT (VOCs)									
LOCATION ID	Sampling Date	Sample Interval	PCE	TCE	1,1,1-TCA	1,1-DCE	cis,1,2-DCE	Vinyl Chloride	1,1-DCA	1,2-DCA	Chloro- methane	Dichlorodi- fluoromethane	Methylene chloride	Acetone	4-Methyl-2- pentanone	Chloroform	Benzene	Toluene	Ethyl- benzene	Xylenes	MtBE
									UPGF	ADIENT											
GEO-SB-103 (D)	04/28/03	12.5-14'	<0.5	5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<10	<2.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GEO-SB-103 (E)	04/28/03	16-18'	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<10	<2.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
								Т	CE IMPA	CTED A	REA										
GEO-SB-102(D)	04/28/03	13-14.5	<10,000	670,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000		<50,000	<200,000	<100,000	<10,000	<10,000	<10,000	<10,000	<10,000	<10,000
GEO-SB-102(E)	04/28/03	18-20'	<250	15,000	<250	<250	<250	<250	<250	<250	<250		<1,300	<5,000	<2,500	<250	<250	<250	<250	<250	<250
B-3	02/12/98	3-8'	<500	52,000	<500	3,700	<500	<500	<500	<500	<500	<500	<500		***	<500					
GEO-SB-101(D)	04/28/03	17-19'	<100	4,700	<100	<100	<100	<100	<100	<100	<100		<500	<2,000	<1,000	<100	<100	<100	<100	<100	<100
GEO-SB-101 (F)	04/28/03	9.5-11'	<500	28,000	<500	<500	<500	<500	<500	<500	<500		<2,500	<10,000	<5,000	<500	<500	<500	<500	<500	<500
B-1	02/12/98	7-9'	<1,000	160,000	<1,000	5,200	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<2,000			<1,000					
		16-18'	<100	2,600	<100	230	<100	<100	<100	<100	<100	<100	<100			<100					
	1. 103	25-27	<1	10	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1				***	
	D. S. D.	34-36'	<1	5.5	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1					
		43-45	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1					
GEO-SB-100 (D)	04/28/03	6-8'	<500	21,000	<500	<500	<500	<500	<500	<500	<500		<2,500	<10,000	<5,000	<500	<500	<500	<500	<500	<500
GEO-SB-100 (C)	04/28/03	10.5-12	<2,500	140,000	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500	***	<13,000	<50,000	<25,000	<2,500	<2,500	<2,500	<2,500	<2,500	<2,500
B-2	02/12/98	7-9'	<1,000	150,000	<1,000	<1,000	21,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000			<1,000					
		16-18'	<50	3,300	<50	<50	300	<50	<50	<50	<50	<50	<50			<50				-	
		25-27'	<2.5	190	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5			<2.5					
		34-36'	<2.5	150	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5			<2.5					
		43-45	<1	26	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1		***			
		52-54'	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1			<1					
B-4	02/12/98	3-8'	<1	<1	<1	140	26	<1	<1	<1	<1	8.1	<1			<1					
GROUND WA	TER STANDA	RDS	5	5	200	7	70	2	70	5	NA	NA	5	3,000	NA	5	5	1,000	700	10,000	70

- 1. All values in ug/l (micrograms per liter); parts per billion.
- 2. Bold exceeds laboratory detection limits.
- 3. Shaded concentrations exceed applicable Ground Water Standard.
- 4. Ground Water Standards are ROD ICLs or MCP Method 1/GW-1 Risk Standards.
- 5. DCE = Dichloroethene
- 6. DCA = Dichloroethane
- 7. TCE = Trichloroethene
- 8. TCA = Trichloroethane
- 9. PCE = Tetrachloroethene
- 10. MTBE = Methyl tert butyl ether

TABLE 2 SUMMARY OF SOIL ANALYTICAL DATA-FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

		GEOINSI	GHT - 1999	TRC -2002														
S: CONSTITUENT	Sample I.D. Sampling Date Depth:	GEO-1 08/25/99 4-6'	GEO-2 09/01/99 6-8'	06/06/02 4-8'	150N25E 06/06/02 12-16'	06/06/02 19-23'	135N35E 06/07/02 11-15'	150N50E 06/07/02 11-15'	0N50E 06/06/02 19-20'	200N50E 06/06/02 12-16'	200N0E 06/07/02 12-16'	0N0E 06/07/02 12-16'	50N 06/07/02 11-15'	75E 6/7/02D 11-15'	Record of Decision Target Cleanup Level			
VOCs																		
Acetone		ND(15)	ND(7.9)	ND(0.006)	ND(0.003)	ND(0.006)	ND(1.6)	ND(0.005)	ND(0.016)	ND(0.003)	ND(0.003)	ND(0.15)	ND(0.16)	0.25(J)				
Benzene		ND(1.5)	ND(0.79)	ND(0.001)	0.0008(J)	ND(0.001)	ND(1.6)	ND(0.001)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0.066)				
Chloroform	1	ND(2.2)	ND(1.2)	ND(0.001)	0.21(J)	ND(0.001)	ND(1.6)	ND(0.001)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	0.043(J)				
Chloromethane		ND(15)	ND(7.9)	ND(0.001)	ND(0.001)	ND(0.001)	ND(1.6)	ND(0.001)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0.066)				
1,1-Dichloroethane		ND(2.2)	ND(1.2)							***								
1,1-Dichloroethene	100	ND(2.2)	ND(1.2)	ND(0.001)	ND(0.001)	ND(0.001)	ND(1.6)	ND(0.001)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0.066)				
1,2-Dichloroethane		ND(2.2)	ND(1.2)	ND(0.001)	ND(0.001)	ND(0.001)	ND(1.6)	ND(0.001)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0.066)				
cis 1,2-Dichloroethene		ND(1.5)	ND(0.79)	ND(0.001)	0.001(J)	ND(0.001)	ND(1.6)	0.002(J)	0.026	ND(0.001)	ND(0.001)	0.52	ND(0.16)	ND(0.066)				
Ethylbenzene		4.8	ND(0.79)	ND(0.001)	0.39(J)	ND(0.001)	ND(1.6)	ND(0.001)	0.001(J)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0.066)				
Methylene chloride		ND(7.4)	ND(3.9)	ND(0.003)	ND(0.003)	ND(0.003)	ND(1.6)	ND(0.003)	ND(0.004)	ND(0.003)	ND(0.003)	ND(0.066)	ND(0.16)	0.21				
MTBE	- 3	ND(15)	ND(7.9)					122										
4-Methyl-2-pentanone		ND(15)	ND(7.9)	ND(0.003)	ND(0.003)	ND(0.003)	ND(1.6)	ND(0,003)	ND(0.004)	ND(0.003)	ND(0.003)	ND(0.066)	ND(0.16)	ND(0.066)				
Tetrachloroethene		40	ND(1.2)	ND(0.001)	0.096	ND(0.001)	ND(1.6)	0.005(J)	ND(0.002)	ND(0.001)	ND(0.001)	0.23	ND(0.16)	0.044(J)	0.0367			
Toluene		ND(2.2)	ND(1.2)	ND(0.001)	0.011	ND(0.001)	ND(1.6)	0.0007(J)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0.066)				
Trichloroethene		220	42	ND(0.001)	83	0.018	110	0.086(J)	0.018	ND(0.001)	ND(0.001)	1.5	8.8	11	0.0127			
1,1,1-Trichloroethane		ND(1.5)	ND(0.79)	ND(0.001)	0.06	ND(0.001)	ND(1.6)	ND(0.001)	ND(0.002)	ND(0.001)	ND(0.001)	ND(0.066)	ND(0.16)	ND(0,066)	0.613			
Vinyl Chloride	100	ND(3)	ND(1.6)	ND(0.001)	ND(0.001)	ND(0.001)	ND(1.6)	ND(0.001)	0.002	ND(0.001)	ND(0,001)	ND(0.066)	ND(0.16)	ND(0.066)				
Xylenes		23.9	1.4	ND(0.001)	1.9(J)	ND(0.001)	3.1	ND(0.001)	0.005	ND(0.001)	ND(0.001)	ND(0.066)	0.2	ND(0.066)				
TOTAL ORGANIC CAR	RBON				_							-						

- All values in mg/kg (milligrams per kilogram; parts per million).
 ND(x) = constituent not detected above practical quantitation limits noted in parentheses.
- 3. BOLD exceeds laboratory detection limits.
- 4. Shaded concentrations exceed Target Cleanup Levels specified in the 1989 Record of Decision (ROD).
- 5. MTBE methyl tert butyl ether
- 6. -- = not analyzed.
- 7. (J) = estimated concentration
- 8. (EB) =detected in equipment blank

TABLE 2 SUMMARY OF SOIL ANALYTICAL DATA-FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

					TRC 2	002				GEOINSIGHT- SE	WER LINE INVESTIG	ATION SOIL DATA	
CONSTITUENT	Sample I.D. Sampling Date Depth:	150N0E 06/07/02 12-16'	100N100E 06/06/02 10-14'	50N0E 06/06/02 12-16'	06/07/02 2-6'	50N 06/07/02 6-10'	50E 6/7/02D 6-10'	06/07/02 15-19'	TL-South 06/07/02 12-16'	GEO-5 6/12/2003 16'	GEO-SB-91 6/12/2003 12'	GEO-SB-92 6/12/2003 16'	Record of Decision Target Cleanup Level
VOCs												11	
Acetone		ND(0.003)	ND(0.003)	ND(0.74)	ND(0.003)	15(JEB)	14(JEB)	ND(0.003)	ND(0.003)	ND(0.23)	ND(0.26)	ND(3.2)	
Benzene		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	ND(0.19)	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	
Chloroform		ND(0.001)	0.0009(J)	ND(0.74)	ND(0.001)	0.13(J)	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	
Chloromethane		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	ND(0.19)	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.012)	ND(0.013)	ND(0.65)	Mary Later
1,1-Dichloroethane										ND(0.006)	ND(0.007)	ND(0.32)	
1,1-Dichloroethene		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	ND(0.19)	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	
1,2-Dichloroethane		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	ND(0.19)	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	ATTENDED
cis 1,2-Dichloroethene		0.0007(J)	0.001(J)	ND(0.74)	ND(0.001)	10	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	A. De Carlo
Ethylbenzene		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	0.19(J)	0.2	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	
Methylene chloride		ND(0.003)	ND(0.003)	1.5	ND(0.003)	0.31(J)	ND(0.18)	ND(0.003)	ND(0.003)	ND(0.006)	ND(0.007)	ND(0.32)	
МТВЕ										ND(0.006)	ND(0.007)	ND(0.32)	A LESS BURNES
4-Methyl-2-pentanone		ND(0.003)	ND(0.003)	ND(0.74)	ND(0.003)	ND(0.19)	ND(0.18)	ND(0.003)	ND(0.003)	ND(0.058)	ND(0.066)	ND(3.2)	
Tetrachloroethene		ND(0.001)	0.099	ND(0.74)	ND(0.001)	ND(0.19)	ND(0.18)	ND(0.003)	ND(0.001)	0.006	ND(0.007)	ND(0.32)	0.0367
Toluene	- 1	ND(0.001)	0.038(J)	ND(0.74)	ND(0.001)	ND(0.19)	ND(0.18)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	
Trichloroethene		0.001(J)	2.1	39	ND(0.001)	6.6	7.4	0.002	ND(0.001)	0.099	ND(0.007)	0.36	0.0127
1,1,1-Trichloroethane		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	ND(0.19)	0.13(J)	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	0.613
Vinyl Chloride		ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	ND(0.19)	0.2	ND(0.001)	ND(0.001)	ND(0.012)	ND(0.013)	ND(0.65)	
Xylenes	- 2.7	ND(0.001)	ND(0.001)	ND(0.74)	ND(0.001)	1.1	1.1	ND(0.001)	ND(0.001)	ND(0.006)	ND(0.007)	ND(0.32)	
TOTAL ORGANIC CAI	RBON							***	***	ND(250)	ND(250)	ND(250)	

- All values in mg/kg (milligrams per kilogram; parts per million).
 ND(x) = constituent not detected above practical quantitation limits noted in parentheses.
- 3. BOLD exceeds laboratory detection limits.
- 4. Shaded concentrations exceed Target Cleanup Levels specified in the 1989 Record of Decision (ROD).
- MTBE methyl tert butyl ether
 --- = not analyzed.
- 7. (J) = estimated concentration
- 8. (EB) =detected in equipment blank

TABLE 3
SUMMARY OF GROUND WATER ANALTYICAL DATA - SEWER LINE AREA
60 OLYMPIA AVENUE
WOBURN, MASSACHUSETTS

Sample I.D.	MW-013	MW-014S	OL-002	Record of Decision
Sampling Date	4/22/2003	4/22/2003	4/22/2003	ARAR Based-Action Levels
CONSTITUENT				
VOCs				
Tetrachloroethene	650	1	3	5
Trichloroethene	280	6	91	5
cis 1,2-Dichloroethene	780	61	4	NA
Vinyl Chloride	ND(10)	19	ND(1)	2
1,1,1-Trichloroethane	ND(10)	ND(1)	ND(1)	NA
1,1-Dichloroethane	ND(10)	ND(1)	ND(1)	5
1,1-Dichloroethene	ND(10)	ND(1)	ND(1)	7
1,2-Dichloroethane	ND(10)	ND(1)	ND(1)	5
Chloroform	ND(10)	ND(1)	ND(1)	100
	No other VOC	s detected above l	aboratory limits.	
INORGANICS				
Chloride	110,000	93,000	270,000	NA
Fluoride	ND(40)	ND(40)	ND(40)	NA
Ammonia (as Nitrogen)	300	400	1,300	NA
Nitrate (as Nitrogen)	30	260	ND(20)	NA
FECAL COLIFORM (per 100 ml)	ND(100)	ND(100)	ND(100)	NA

- 1. All values in ug/L (micrograms per liter; parts per billion), except where noted.
- 2. ND(x) = constituent not detected above practical quantitation limits noted in parentheses.
- 3. BOLD exceeds laboratory detection limits.
- 4. Shaded concentrations exceed Target Cleanup Levels specified in the 1989 Record of Decision (ROD).

TABLE 4 SUMMARY OF PID DATA AND ASSOCIATED LABORATORY ANALYSES - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

			<u>"</u>	
DATA	LOCATION	DEPTH(FEET)	PID	LABORATORY ANALYSES
	CTED AREA - PREV	OUS GEOINSIGH	T INVESTIGA	TION AUGUST 1999
9/8/99	GEO-1	0-2	6.6	
9/8/99	GEO-1	2-4	2.4	
9/8/99	GEO-1	4-6	1729	Soil VOC
9/8/99	GEO-1	6-8	510 328	
9/8/99 9/8/99	GEO-1 GEO-1	8-10 10-12	328 296	
9/8/99	GEO-1	12-14	90	
9/8/99	GEO-1	14-16	17.2	
9/8/99	GEO-1	16-18	2	
9/8/99	GEO-1	20-22	1.1	
9/8/99	GEO-2	0-2	0	
9/8/99	GEO-2	2-4	18	
9/8/99	GEO-2	4-6		
9/8/99	GEO-2	6-8	371	Soil VOC
9/8/99	GEO-2	8-10	146	
9/8/99	GEO-2	10-12	161	
9/8/99	GEO-2	12-14	1.6	
9/8/99	GEO-2	14-16	2.2	
9/8/99	GEO-2	16-18	2.2	
9/8/99	GEO-2	20-22	0.4	
TCE IMPA	CTED AREA - MAIN	VOC PLUME		
4/28/03	GEO-SB-98	6	413	KMn04-D, TOC, Soil VOC
4/28/03	GEO-SB-99	4		KMn04-D
4/28/03	GEO-SB-99	5		KMn04-D
4/28/03	GEO-SB-99	6	0	
4/28/03	GEO-SB-100	4	1.3	
4/28/03	GEO-SB-100	7	598	KMn04-D, TOC, Soil VOC, Water VOC
4/28/03	GEO-SB-100	11		TOC, Soil VOC, Water VOC
4/28/03	GEO-SB-100	16	14.7	
4/28/03 4/28/03	GEO-SB-101 GEO-SB-101	4 6	4.1 491	
4/28/03	GEO-SB-101	10	491	TOC, Soil VOC, Water VOC
4/28/03	GEO-SB-101	15		KMn04-D, TOC, Soil VOC, Water VOC
4/28/03	GEO-SB-101	18	690	KMn04-D, TOC, Soil VOC, Water VOC
4/25/03	GEO-SB-102	13		TOC, Soil VOC, Water VOC
4/25/03	GEO-SB-102	14.5		TOC, Soil VOC
4/25/03	GEO-SB-102	16	504	
4/25/03	GEO-SB-102	19		KMn04-D, TOC, Soil VOC, Water VOC
4/25/03	GEO-SB-103	4.5	0	KMn04-D, Soil VOC, Water VOC
4/25/03	GEO-SB-103	13	0	Soil VOC, TOC, Water VOC
4/25/03	GEO-SB-103	17	0	KMn04-D, Soil VOC, TOC, Water VOC
TCE IMPA	CTED AREA - SEWE	R LINE INVESTIG	ATION	
6/11/03	GEO-SB-97	0-2	2.4	
6/11/03	GEO-SB-97	2-4	0.9	
6/11/03	GEO-SB-97	4-6	0.9	
6/11/03	GEO-SB-97	6-8	0.7	
6/11/03	GEO-SB-97	8-10	1.3	
6/11/03	GEO-SB-97	10-12	0.9	
6/11/03	GEO-SB-96	0-2	0	
6/11/03	GEO-SB-96	2-4	0	
6/11/03	GEO-SB-96	4-6	0	
6/11/03	GEO-SB-96	6-8	1.9	
6/11/03	GEO-SB-96	8-10	0.2	
6/11/03	GEO-SB-96	10-12	0.4	
6/11/03	GEO-SB-95 GEO-SB-95	3 5	0	
6/11/03	GEO-SB-95 GEO-SB-95	5 7	0	
6/11/03	GEO-SB-95	11	0	
6/12/03	GEO-SB-93	0-2	0	
6/12/03	GEO-SB-94	0-2 2-4	0	
6/12/03	GEO-SB-94	4-6	0	
6/12/03	GEO-SB-94	6-8	0	
6/12/03	GEO-SB-94	8-10	ő	
0/12/03				

TABLE 4 SUMMARY OF PID DATA AND ASSOCIATED LABORATORY ANALYSES - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

	[****			<u> </u>
DATA	LOCATION	DEPTH(FEET)	PID	LABORATORY ANALYSES
TCE IMPA	CTED AREA - SEWE	R LINE INVESTIG	ATION	•
6/12/03	GEO-5	0-2	0	
6/12/03	GEO-5	2-4	0	
6/12/03	GEO-5	6-8	0	
6/12/03	GEO-5	8-10	0	
6/12/03	GEO-5	10-12	0	
6/12/03	GEO-5	12-14	0	
6/12/03	GEO-5	14-16	5.9	KMn04-D, TOC, VOC
6/12/03	GEO-SB-92	0-2	0	
6/12/03	GEO-SB-92	2-4	0	
6/12/03	GEO-SB-92	4-6	0	
6/12/03	GEO-SB-92	6-8	0	
6/12/03	GEO-SB-92	8-10	0	
6/12/03	GEO-SB-92	10-12	0	
6/12/03	GEO-SB-92	12-14	0	
6/12/03	GEO-SB-92	14-16	8.7	_ VOC, TOC
6/12/03	GEO-SB-91	0-2	0	
6/12/03	GEO-SB-91	2-4	0	
6/12/03	GEO-SB-91	4-6	0.5	
6/12/03	GEO-SB-91	6-8	0	
6/12/03	GEO-SB-91	8-10	0	
6/12/03	GEO-SB-91	10-12	0	
6/12/03	GEO-SB-91	12-14	0	KMn04-D, TOC, VOC
6/12/03	GEO-SB-91	14-16	0	
6/12/03	GEO-6 (GEO-SB-90)	0-2	0	
6/12/03	GEO-6 (GEO-SB-90)	2-4	0	
6/12/03	GEO-6 (GEO-SB-90)	4-6	0	
6/12/03	GEO-6 (GEO-SB-90)	6-8	0	
6/12/03	GEO-6 (GEO-SB-90)	8-10	0	
6/12/03	GEO-6 (GEO-SB-90)	10-12	0	
6/12/03	GEO-6 (GEO-SB-90)	12-14	0	
6/12/03	GEO-6 (GEO-SB-90)	14-16	0	
6/12/03	GEO-7	0-2	0	
6/12/03	GEO-7	2-4	0	
6/12/03	GEO-7	4-6	0	
6/12/03	GEO-7	6-8	0	
6/12/03	GEO-7	8-10	0	
6/12/03	GEO-7	10-12	0	
6/12/03	GEO-7	12-14	0	
6/12/03	GEO-7	14-16	0	

- 1. KMn04-D = Potassium Permanganate Demand
- 2. VOC = Volatile Organic Compounds
- 3. TOC = Total Organic Carbon
- 4. PID = Photionization Detector
- 5. --- = No analyses performed

TABLE 5 SUMMARY OF FIELD PARAMETER DATA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

Monitoring Well	Date	Screen Interval	DO (mg/L)	ORP (millivolts)	Temperature (C)	Conductivity (mS/cm)	pН
UPGRADIENT							
OL-005	06/02/03	3.5-8.5'	0.61	196	9.92	1.029	6.56
TCE IMPACTED	AREA						
OL-002	09/16/97	4-9'	0.27	-110.9	16.82	0.539	6.26
OL-002	04/22/03		0.10	-41	7.50	0.328	6.31
OL-002	06/02/03		0.20	69	12.98	0.468	6.47
OL-2M	06/02/03	21.5-31.5'	0.32	175	12.11	0.282	5.86
GEO-4	06/24/03	6-16'	0.25	49	13.93	0.891	6.54
TEST-1	08/06/02	1.8-16.8'	0.54	-0.7*	19.05	0.555	6.75
TEST-1	06/02/03		0.20	139	11.61	0.346	6.77
GEO-5	06/24/03	2-12'	0.26	141	15.39	0.000	6.60
MW-013	08/07/02	7-17'	1.73	-40.7*	20.17	0.681	6.28
MW-013	04/22/03		0.18	186	7.57	0.202	6.24
MW-013	06/02/03		0.27	186	12.30	0.327	6.30
GEO-7	06/24/03	6-16'	3.61**	75	14.85	0.113	6.62
OL-003	09/16/97	4-9'	0.24	-80.2	16.41	0.376	6.26
OL-003	08/08/02		0.78	-77.2*	19.72	0.624	6.49
OL-003	06/02/03		0.31	185	10.74	0.428	6.12
OL-3M	06/02/03	21.5-31.5'	0.23	192	11.09	0.084	6.04
GEO-3	06/24/03	6-16'	0.30	64	14.18	0.861	6.72
MW-14S	04/22/03	5-15'	0.71	102	5.18	0.242	6.09
MW-14S	06/02/03		0.27	182	9.92	0.329	6.25

- 1. DO = Dissolved Oxygen.
- 2. ORP = Oxygen Reduction Potential (millivolts).
- 3. --- = not analyzed.
- 4. 1997 field data summarized from Draft Technical Memorandum Phase I Pre-Design Investigation (BRE, March 1998)
- 5. * = Extended sampling time (5 hr.)
- 6. ** = Extremely silty during ground water sampling.
- 7. pH values in standard pH units.

TABLE 6

SUMMARY OF GROUND WATER ANALYTICAL DATA - METALS 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

		METALS							
Location ID	Sampling Date	IRON (TOTAL)	MANGANESE (TOTAL)	IRON (DISSOLVED)	MANGANESE (DISSOLVED)				
OL-002	09/16/97			1,020	2,920				
OL-003	09/16/97			4,800	2,380				
GEO-4	06/24/03			2,400	6,300				
GEO-3	06/24/03			7,500	6,300				
GEO-5	06/24/03	72,000	5,000	<100	1,600				

- 1. All values in ug/l (micrograms per liter).
- 2. Bold exceeds laboratory detection limits.

TABLE 7 SUMMARY OF SOIL AND GROUND WATER PAIRS - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

	VOC PLUME AREA												
CONSTITUENT	GEO-S	B-98	GEO-SB-100				GEO-SB-101						
Sample I.D.	GEO-SB-98	NA	GEO-SB-100(A)	GEO-SB-100(D)	GEO-SB-100(B)	GEO-SB-100(C)	GEO-SB-101(A)	GEO-SB-101(F)	GEO-SB-101(B)	GEO-SB-101(E)	GEO-SB-101(C)	GEO-SB-101(D)	
	SOIL	GW	SOIL	GW	SOIL	GW	SOIL	GW	SOIL	GW	SOIL	GW	
Units	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	
Sampling Date	4/25/2003		4/28/2003	4/28/2003	4/28/2003	4/28/2003	4/28/2003	4/28/2003	4/28/2003	4/28/2003	4/28/2003	4/28/2003	
Stratigraphic Unit	Top Silt/Clay 6'		Silt										
Depth:	0		7'	6-8'	11'	10.5-12'	10*	9.5-11'	15'	14-16'	18'	17-19'	
VOCs													
Acetone	ND(3,800)	NA	ND(6,200)	ND(10,000)	ND(13,000)	ND(50,000)	ND(3,100)	ND(10,000)	ND(6,800)	ND(20,000)	ND(5,600)	ND(2,000)	
Benzene	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Chloroform	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Chloromethane	ND(770)	NA	ND(1,200)	ND(500)	ND(2,600)	ND(2,500)	ND(620)	ND(500)	ND(1,400)	ND(1,000)	ND(1,100)	ND(100)	
1,1-Dichloroethane	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
1,1-Dichloroethene	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
1,2-Dichloroethane	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
cis 1,2-Dichloroethene	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Ethylbenzene	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Methylene chloride	ND(1,500)	NA	ND(2,500)	ND(2,500)	ND(5,200)	ND(13,000)	ND(1,200)	ND(2,500)	ND(2,700)	ND(5,000)	ND(2,300)	ND(500)	
MTBE	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
4-Methyl-2-pentanone	ND(3,800)	NA	ND(6,200)	ND(5,000)	ND(13,000)	ND(25,000)	ND(3,100)	ND(5,000)	ND(6,800)	ND(10,000)	ND(5,600)	ND(1,000)	
Tetrachloroethene	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Toluene	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Trichloroethene	ND(380)	NA	14,000	21,000	23,000	140,000	740	28,000	8,800	47,000	7,700	4,700	
1,1,1-Trichloroethane	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
Vinyl Chloride	ND(770)	NA	ND(1,200)	ND(500)	ND(2,600)	ND(2,500)	ND(620)	ND(500)	ND(1,400)	ND(1,000)	ND(1,100)	ND(100)	
Xylenes	ND(380)	NA	ND(620)	ND(500)	ND(1,300)	ND(2,500)	ND(310)	ND(500)	ND(680)	ND(1,000)	ND(560)	ND(100)	
TOTAL ORGANIC CARBON	2,200	NA	610	NA	ND(560)	NA	ND(1,100)	NA	ND(660)	NA	ND(560)	NA	

- NA = Not analyzed
- 2. ND(x) = constituent not detected above practical quantitation limits noted in parentheses.
- 3. BOLD exceeds laboratory detection limits.
- 4. MTBE = methyl tertiary butyl ether

TABLE 7 SUMMARY OF SOIL AND GROUND WATER PAIRS - FDDA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

	VOC PLUME AREA (continued)					UPGRADIENT BACKGROUND							
CONSTITUENT	GEO-SB-102					GEO-SB-103							
Sample I.D.	GEO-SB-102(A)	GEO-SB-102(B)	GEO-SB-102(D)	GEO-SB-102(C)	GEO-SB-102(E)	GEO-SB-103(A)	NA	GEO-SB-103(B)	GEO-SB-103(D)	GEO-SB-103(C)	GEO-SB-103(E)		
	SOIL	SOIL	GW	SOIL	GW	SOIL	GW	SOIL	GW	SOIL	GW		
Units	(ug/kg)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)	(ug/kg)	(ug/l)		
Sampling Date	4/25/2003	4/25/2003	4/28/2003	4/25/2003	4/28/2003	4/25/2003		4/25/2003	4/25/2003	4/25/2003	4/25/2003		
Stratigraphic Unit	Sand	Silt	Sand/Silt	Silt	Silt	Sand		Silt	Silt	Silt	Silt 16-18'		
Depth:	13'	14.5	13-14.5'	19'	18.5-20'	4.5'	·	13'	12.5-14'	17'	10-18		
VOCs								1					
Acetone	ND(2,600)	ND(48,000)	ND(200,000)	ND(14,000)	ND(5,000)	ND(360)	NA	ND(410)	ND(10)	ND(390)	ND(10)		
Benzene	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Chloroform	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Chloromethane	ND(520)	ND(9,600)	ND(10,000)	ND(2,800)	ND(250)	ND(18)	NA	ND(20)	ND(0.5)	ND(20)	ND(0.5)		
1,1-Dichloroethane	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
1,1-Dichloroethene	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
1,2-Dichloroethane	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
cis 1,2-Dichloroethene	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Ethylbenzene	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Methylene chloride	ND(1,000)	ND(19,000)	ND(50,000)	ND(5,500)	ND(1,300)	ND(91)	NA	ND(100)	ND(2.5)	ND(98)	ND(2.5)		
мтве	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
4-Methyl-2-pentanone	ND(2,600)	ND(48,000)	ND(100,000)	ND(14,000)	ND(2,500)	ND(91)	NA	ND(100)	ND(5)	ND(98)	ND(5)		
Tetrachloroethene	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Toluene	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Trichloroethene	769	120,000	670,000	13,000	15,000	16	NA	ND(10)	5	ND(10)	ND(0.5)		
1,1,1-Trichloroethane	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
Vinyl Chloride	ND(520)	ND(9,600)	ND(10,000)	ND(2,800)	ND(250)	ND(18)	NA	ND(20)	ND(0.5)	ND(20)	ND(0.5)		
Xylenes	ND(260)	ND(4,800)	ND(10,000)	ND(1,400)	ND(250)	ND(9)	NA	ND(10)	ND(0.5)	ND(10)	ND(0.5)		
TOTAL ORGANIC CARBON	ND(500)	ND(600)	NA	640	NA NA	NA _	NA	ND(490)	NA	ND(510)	NA NA		

Notes:

- 1. NA = Not analyzed.
- 2. ND(x) = constituent not detected above practical quantitation limits noted in parentheses.
- 3. BOLD exceeds laboratory detection limits.

TABLE 8 SUMMARY OF GRAIN SIZE DATA 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

Sampling Locations:	GEO-1	GEO-1	GEO-1	GEO-SB-100-7	GEO-SB-101-4	GEO-SB-101-17	GEO-SB-101-18	GEO-SB-101-20	GEO-7	GEO-7
Sample Depth:	4-8 feet	14-18 feet	20-22 feet	7 feet	4 feet	17 feet	18 feet	20 feet	6 feet	9 feet
GRADATION										
Coarse Gravel	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%
Fine Gravel	0%	0%	0%	0%	13%	0%	0%	0%	50%	39%
Gravel Subtotal:	0%	0%	0%	0%_	13%	0%	0%	0%	50%	44%
Coarse Sand	0%	1%	0%	0%	14%	0%	0%	0%	27%	20%
Medium Sand	2%	1%	2%	1%	63%	2%	1%	0%	18%	29%
Fine Sand	4%	2%	7%	3%	9%	2%	11%	1%	4%	4%
Sand Subtotal:	7%	4%	10%	4%	86%	4%	12%	1%	49%	53%
Silt and Clay					1%				1%	3%
Silt	81%	80%	76%	83%		89%	83%	88%		
Clay	12%	16%	14%	13%		_7%	5%	11%		
Fines Subtotal:	93%	96%	90%	96%	1%	96%	88%	99%	1%	3%
Total (as a check)	100%	100%	100%	100%	100%	100%	100%	100%_	100%	100%

NOTES:

1. Percentages based upon laboratory sieve analyses performed by Geotesting Express, Inc. on representative composite samples collected by GeoInsight from the specified soil borings.

TABLE 9 SUMMARY OF PERMANGANATE DEPLETION STUDY 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

1	GEO-SB-103(A)	GEO-SB-103(C)	GEO-SB-102(C)	GEO-SB-101(B)	GEO-SB-101(C)	GEO-SB-100(A)	GEO-SB-99(A)	GEO-SB-99(B)	GEO-SB-98	GEO-SB-91	GEO-5
Sampling Date	4/25/2003	4/25/2003	4/25/2003	4/28/2003	4/28/2003	4/28/2003	4/25/2003	4/25/2003	4/25/2003	6/12/2003	6/24/2003
Stratigraphic Unit	Upper Sand	Silt	Silt	Silt	Silt	Silt	Peat	Peat/Sand	Silt	Silt	Silt
Depth:	4.5'	17'	19'	15'	18'	7'	4'	_5'	6'	12'	16'
Constituent:		- -					<u>-</u>			Ī	,,,
Trichloroethene (ug/kg)	16	ND(10)	13,000	8,800	7,700	14,000			ND(380)	ND(7)	99
Total Organic Carbon (mg/kg)		ND(510)	640	ND(660)	ND(560)	610			2,200	ND(250)	ND(250)
Soil Wt per KMnO4 wt	3,200	2,000	1,200	3,900	4,900	5,600	<27	<119	700	4,500	1,500
Calculated Permanganate Demand	0.0020	0.0032	0.0053	0.0016	0.0013	0.0011	> 0.2343	> 0.0532	0.0090	0.0014	0.0042
(moles MnO4 per kg of soil)	_										

NOTES:

- 1. --- = Not analyzed.
- 2. ND(x) = constituent not detected above practical quantitation limits noted in parentheses.
- 3. BOLD exceeds laboratory detection limits.

TABLE 10 SUMMARY OF SITE SPECIFIC SORPTION CALCULATIONS 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

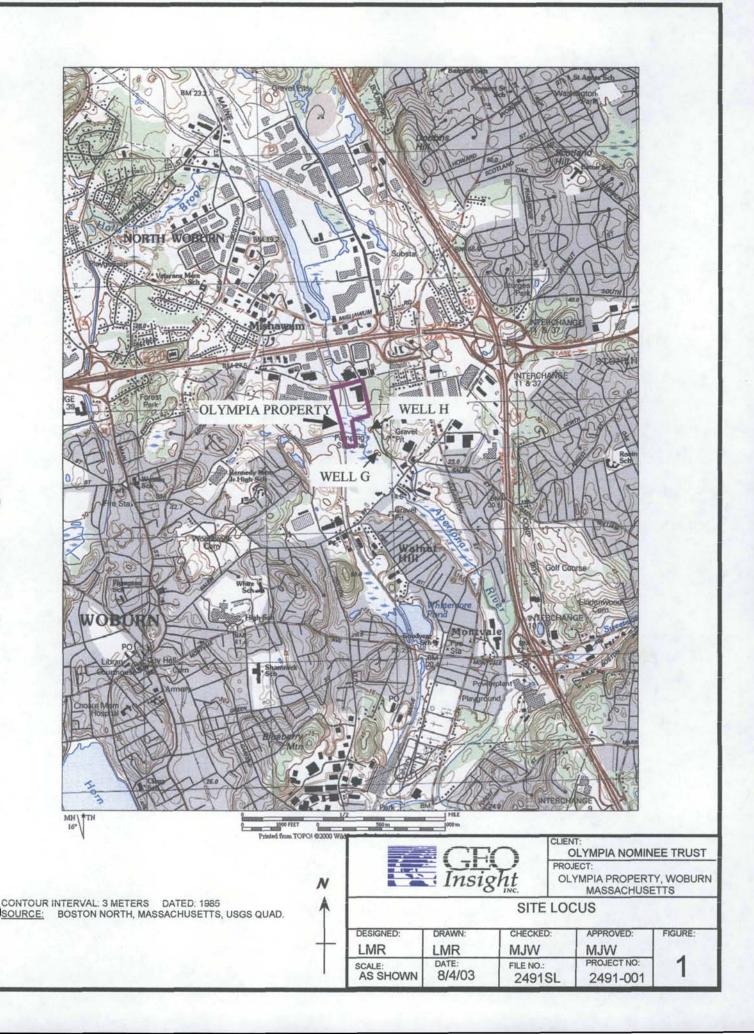
Sample Pair ID	Depth of soil sample (feet)	Depth of ground water sample (feet)	Cs (ug/kg)	Moisture Content (%)	Adjusted Cs (ug/kg)	Cw (ug/l)	Cw % Solubility	Percent of TCE mass in soil sample derived from ground water	TOC (mg/kg)	Foc	Kd	Koc	Unit
< 1% Solubility										··			
GEO-SB-101 (C/D) (18')	18	17-19	7,700	24	4,724	4,700	0.4%	19	ND(560)	0.00028	1.01	3589.7	SILT
< 10% Solubility			· .										
GEO-SB-100(A/D) (7')	7	6-8	14,000	20	7,000	21,000	1.9%	38	610	0.00061	0.33	546.4	SILT
GEO-SB-102 (C/E) (19')	19	18-20	13,000	26	5,720	15,000	1.4%	41	640	0.00064	0.38	595.8	SILT
> 10% Solubility													
GEO-SB-101 (A/F) (10')	10	9-11	740	11	-2,421	28,000	2.5%	468	ND(1,100)	0.00055	NA	NA	SAND
GEO-SB-101 (B/E) (15')	15	14-16	8,800	23	-4,034	47,000	4.3%	160	ND(660)	0.00033	NA	NA	SILT
GEO-SB-100 (B/C) (11')	11	10-12	23,000	24	-16,120	140,000	12.7%	192	ND(560)	0.00028	NA	NA	SILT
GEO-SB-102 (A/D) (13')	13	13-14.5	760	16	-106,562	670,000	60.9%	16,792	ND(500)	0.00025	NA	NA	SAND
GEO-SB-102 (B/D) (14.5')	14.5	13-14.5	120,000	26	-85,400	670,000	60.9%	196	ND(600)	0.0003	NA	NA	SILT

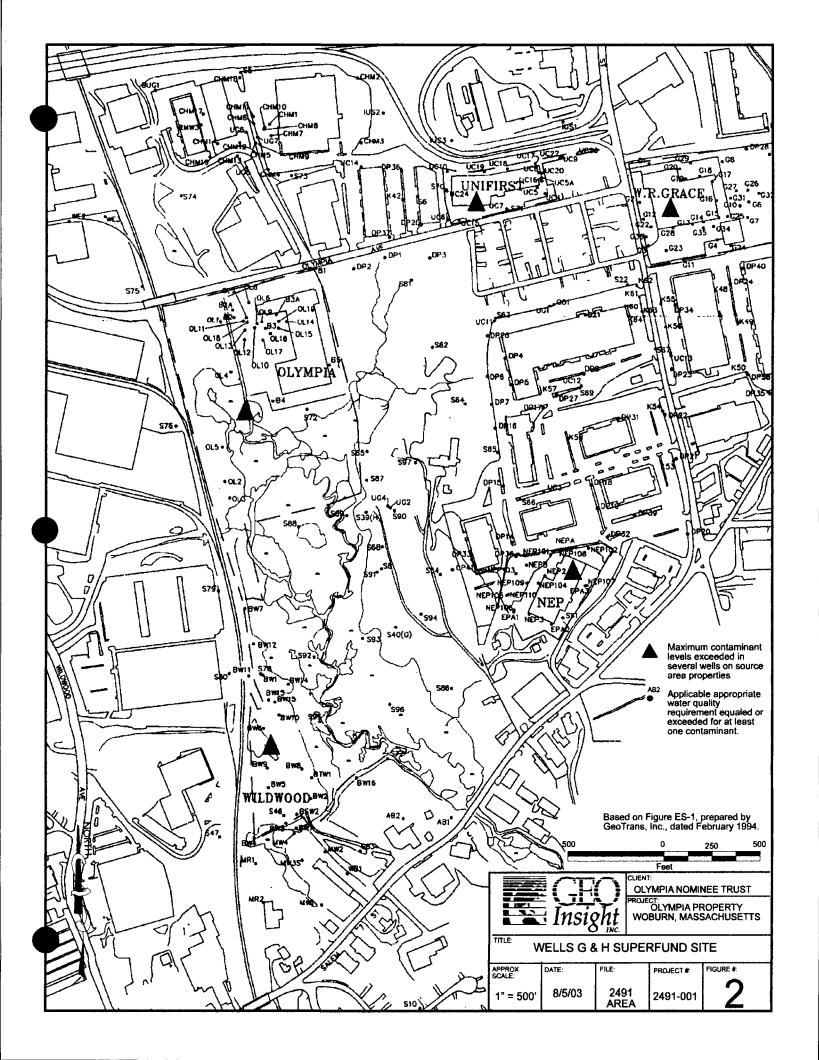
NOTES:

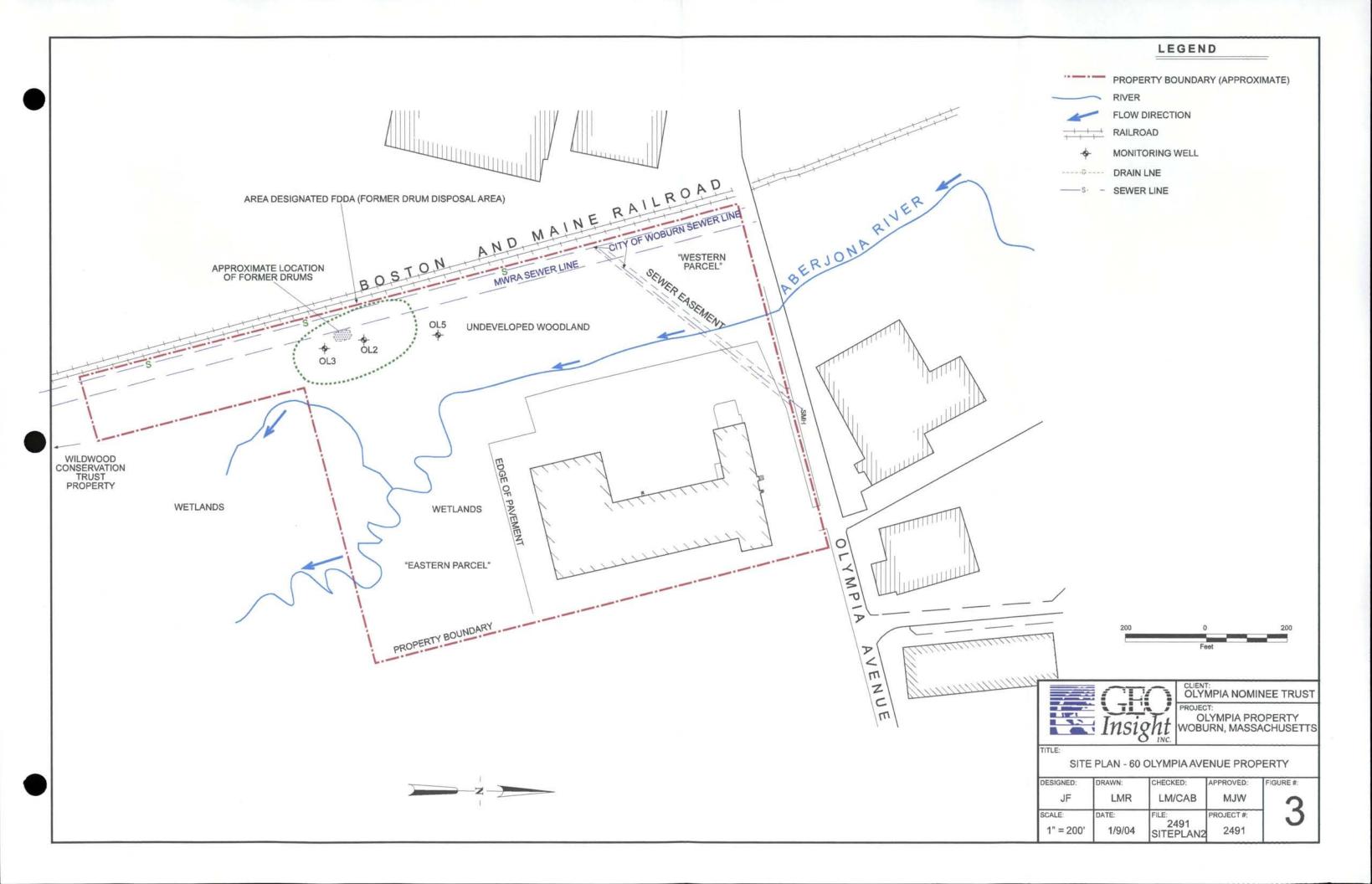
- 1. Italics = half detection limit presented as fraction of organic carbon (Foc).
- 2. Cs = concentration in soil.
- 3. Cw = concentration in ground water.
- 4. Kd = solid-aqueous partitioning coefficient.
- 5. Koc = organic carbon partitioning coefficient.
- 6. Adjusted Cs subtracts mass of TCE in moisture content utilizing ground water concentrations analyzed for separate water samples.
- 7. If percentage of TCE mass derived from water in the soil sample is greater than 100%, then the mass detected in the soil sample is derived from ground water.
- 8. TCE Solubilty 1,100,000 ug/l

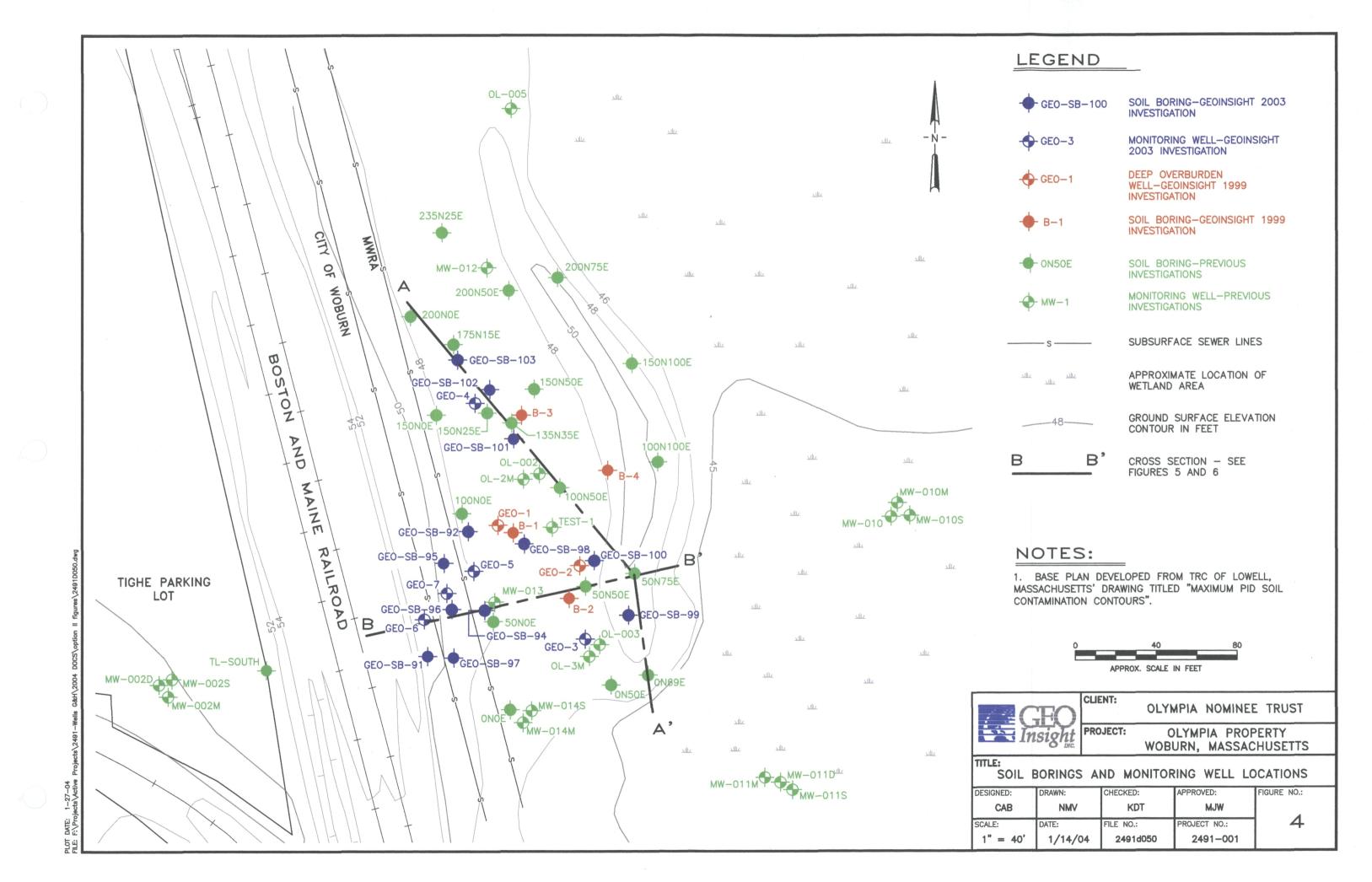
TABLE 11 DETAILED REMEDIAL ALTERNATIVE EVALUATION 60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

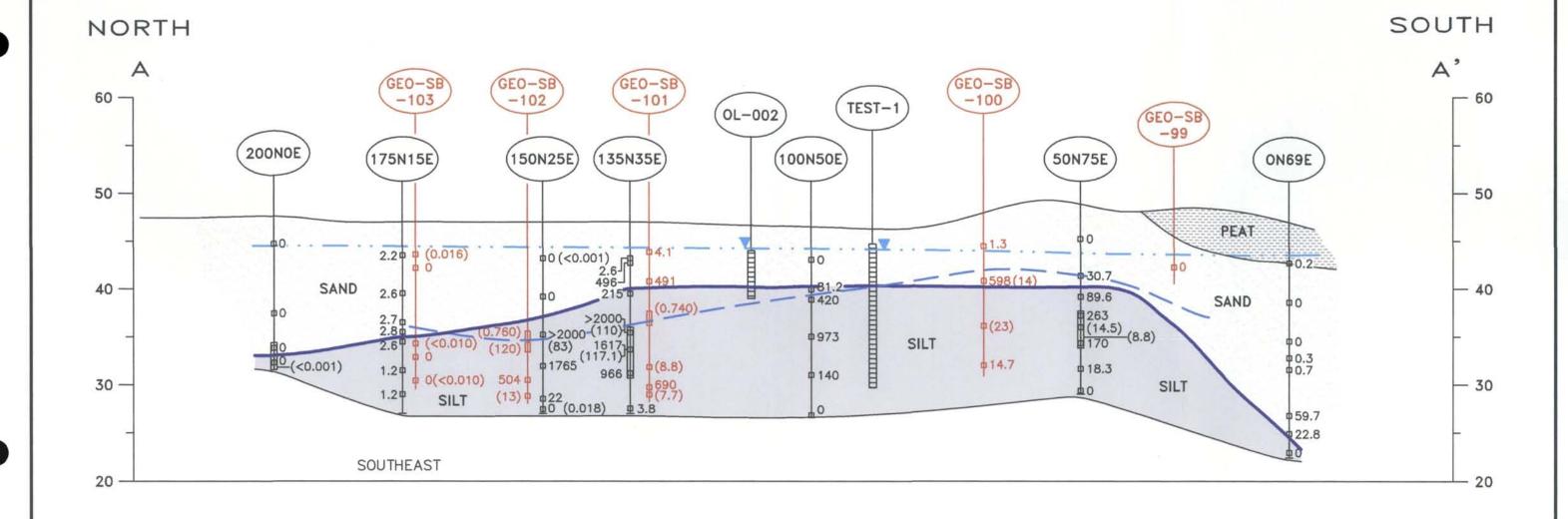
	ALTERNATIVE	ADVANIAGES :	DISADVANTACKS	ESTIMATED COST
SOIL EX	XCAVATION	TO CAN CAN SER AND A CONTROL OF THE	C. d. of Grand Signature () Conduction () Conduct	<u> </u>
1A	Soil Excavation with Off-Site Treatment and Disposal Excavate 9,500 cubic yards Transport and disposal off-site Excavation dewatering and treatment Sheet pile for shoring excavation Soil Excavation with On-Site Stabilization	Removes CVOC mass adsorbed to soil Certainty regarding portion of FDDA treated	 High cost Heavy truck traffic Significant site disruption and requires upgrades for access Appreciable water management issues (soil can not be transported wet) 	\$4,803,000
1B	 Excavation with On-Site Stabilization Excavate 9,500 cubic yards Mix soil with stabilization reagent on site (asphalt emulsion and/or cement) in pug mill Replace stabilized soil into excavation Excavation dewatering and treatment Sheet pile for shoring excavation CAL OXIDATION	 Remediation is complete when stabilization is complete Mobility of residual VOCs is reduced Certainty regarding portion of FDDA treated 	 Appreciable on-site soil handling, space limitations Increased volume of soil due to stabilization mixture VOC mass, although stabilized, remains on site 	\$1,849,000
CHENII	In-situ Soil Mixing with Potassium Permanganate Using Earth	Minimum and a contact with	Mathod of ouidant delivery has	
2A	Augers Treat 9,500 cubic yards Large-diameter augers mix oxidant in situ Pump in reagent during mixing SX safety factor used in cost estimate	 Mixing promotes contact with oxidant Method is not affected by soil conditions 	 Method of oxidant delivery has not previously been used (i.e., this would be a test case) Significant site disruption and requires upgrades for access Because of high mobilization costs, requires excess permanganate to assure treatment efficiency 	\$1,519,000
	Sodium Permanganate Solution Injection (passive drainage and diffusion) Install injection wells/trenches Inject liquid permanganate via gravity feed, multiple events 4X safety factor used in cost estimate	 Ability for multiple permanganate injections Ease of delivery system installation 	 Oxidant solution may migrate outside the FDDA Delivery of oxidant requires close spacings for injection system 	\$946,000
2C	Sodium Permanganate Solution Injection and Recirculation Wells Install injection system Install recirculation system Recirculate permanganate through impacted area 3X to 4X safety factor used in cost estimate	 Recirculation gradients enhance diffusion of permanganate Ability for multiple permanganate injections Hydraulic control 	 Slow recirculation due to soil conditions Permanganate solution will be preferentially distributed in areas of higher permeability Operation and maintenance of recirculation system required 	\$868,000 to \$1,029,000
2D	Sodium Permanganate Injection with Sheet Pile Wall Install sheet pile wall Install injection system Inject liquid permanganate via gravity feed, multiple events 2X to 4X safety factor used in cost estimate ****SELECTED ALTERNATIVE***	 Ease of delivery system installation Ability for multiple permanganate injections Sheet pile wall contains permanganate and limits outside influences Sheet pile wall limits migration of TCE into the central valley 	Delivery of oxidant requires close spacings for injection system	\$755,000 to \$1,076,000
2E	Sodium Permanganate Injection, and Recirculation, with Sheet Pile Wall Install sheet pile wall Install injection system Install recirculation system Recirculate permanganate through impacted area 2X to 4X safety factor used in cost estimate XCAVATION AND CHEMICAL OXIDATION	Recirculation gradients enhance distribution of permanganate Ability for multiple permanganate injections Hydraulic control	 Slow recirculation due to soil conditions Permanganate solution would be preferentially distributed in areas of higher permeability. Operation and maintenance of recirculation system required. 	\$824,000 to \$1,145,000
3A	Ex-Situ Soil Permanganate Addition and Treatment Excavate 9,500 cubic yards Mix soil with permanganate ex-situ on site Replace treated soil into excavation Excavation dewatering and treatment	Remediation is complete once on-site treatment is complete.	 Appreciable on-site soil handling, space limitations Water handling and treatment 	\$1,113,000
3B	Targeted Soil Excavation Followed by Permanganate Addition Excavate 2,375 cubic yards of impacted soil Transport and dispose offsite Excavation dewatering and treatment Install injection delivery system Inject liquid permanganate in several events	 Certainty of treatment in "hot spot" areas Ability for multiple permanganate injections 	 Heavy truck traffic Significant site disruption and requires upgrades for access Appreciable water management issues (soil can not be transported wet) 	\$1,968,000
3C	Targeted Soil Mixing (4,750 cubic yards), followed by Permanganate Addition Large diameter augers mix oxidant in situ Install injection system in untreated area Inject liquid permanganate in multiple events	 Mixing promotes contact with oxidant Method is not affected by soil conditions 	 Two methods of permanganate injection increases overall costs Oxidant solution may migrate outside the FDDA 	\$1,193,000
3D	Targeted Soil Mixing (2,375 cubic yards), followed by Permanganate Addition Large diameter augers mix oxidant in situ Install injection system in untreated area Inject liquid permanganate in multiple events	 Mixing promotes contact with oxidant Method is not affected by soil conditions 	 Two methods of permanganate injection increases overall costs Oxidant solution may migrate outside the FDDA 	\$1,129,000
ENHAN	ICED BIOREMEDIATION			
4A	Injection of electron donor to increase biological breakdown Install injection system and sheet pile wall Injection of food source (electron donor) and microbes AX safety factor used in cost estimate	 Increases natural biodegradation Sheet pile wall limits migration of TCE into the central valley 	Delivery of nutrient/microbes requires close spacings for injection system	\$1,316,000







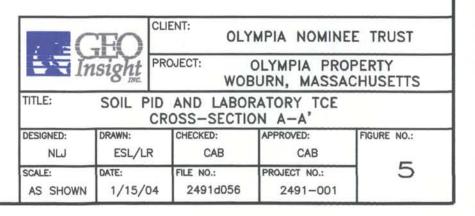




HORIZONTAL SCALE IN FEET

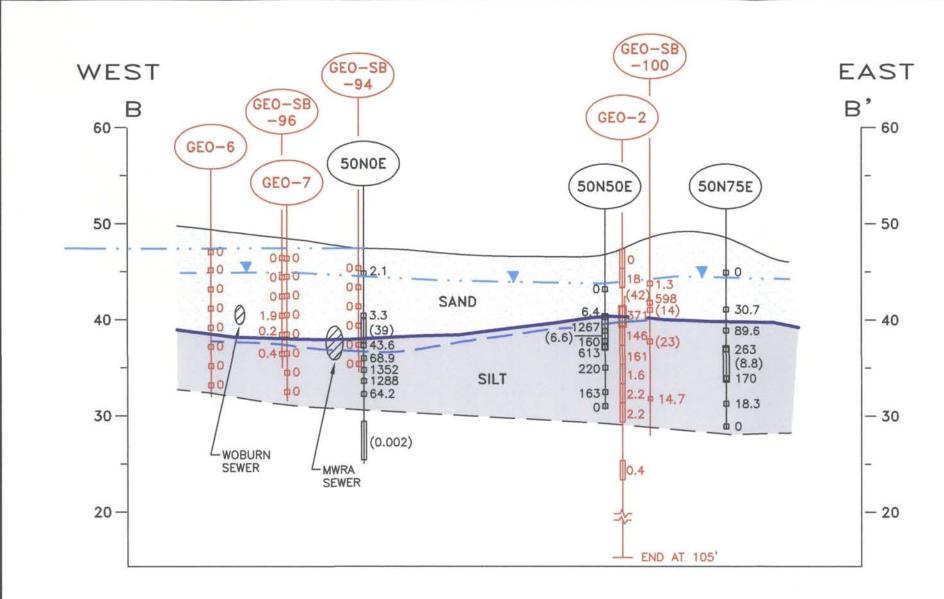
NAVD 1988

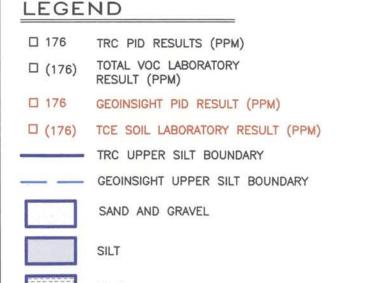




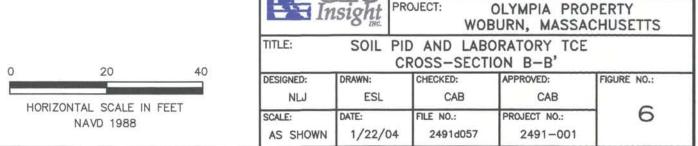
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LEGEND





GROUND WATER TABLE (8/02)



CLIENT:

PROJECT:

OLYMPIA NOMINEE TRUST

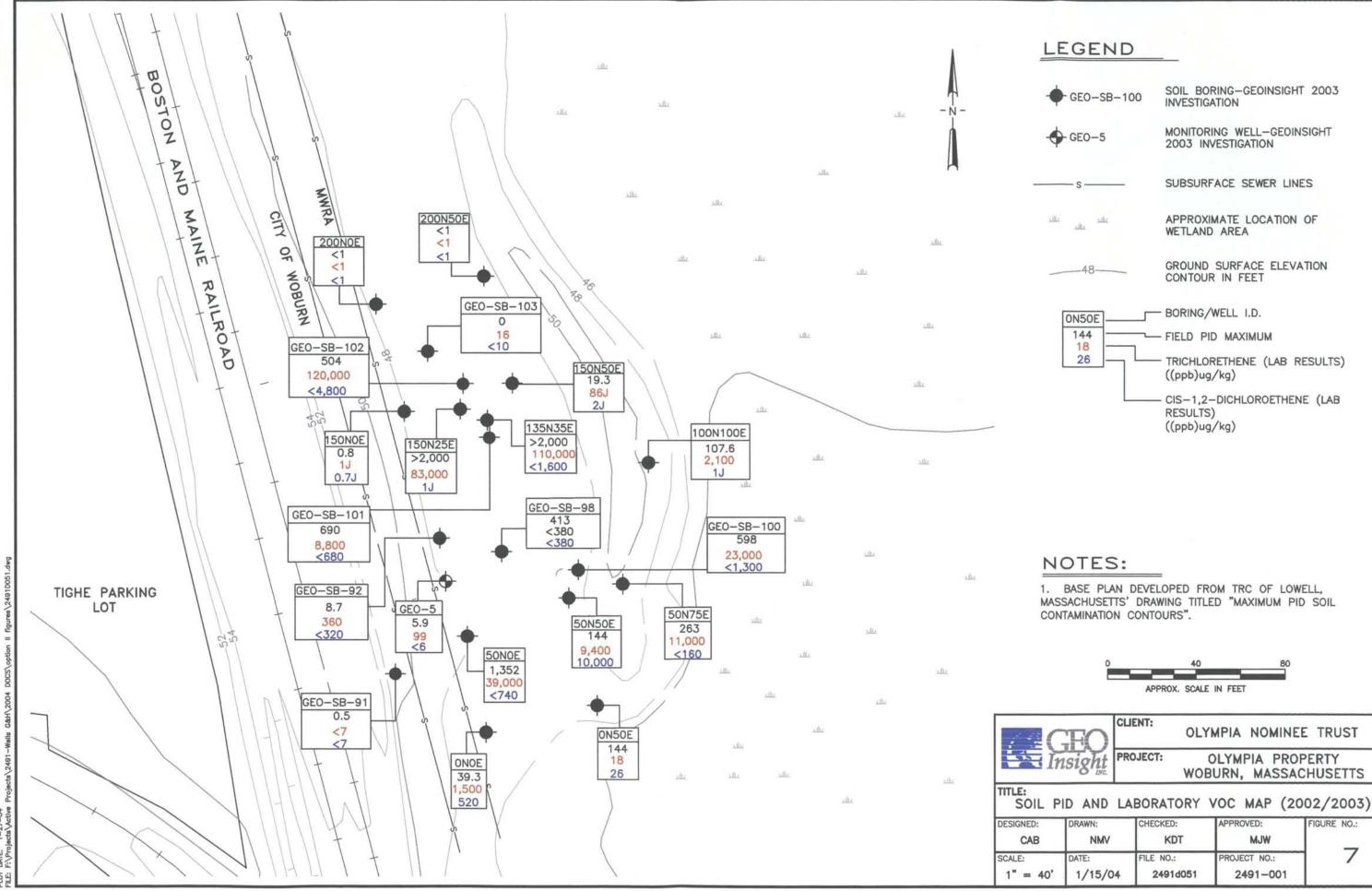
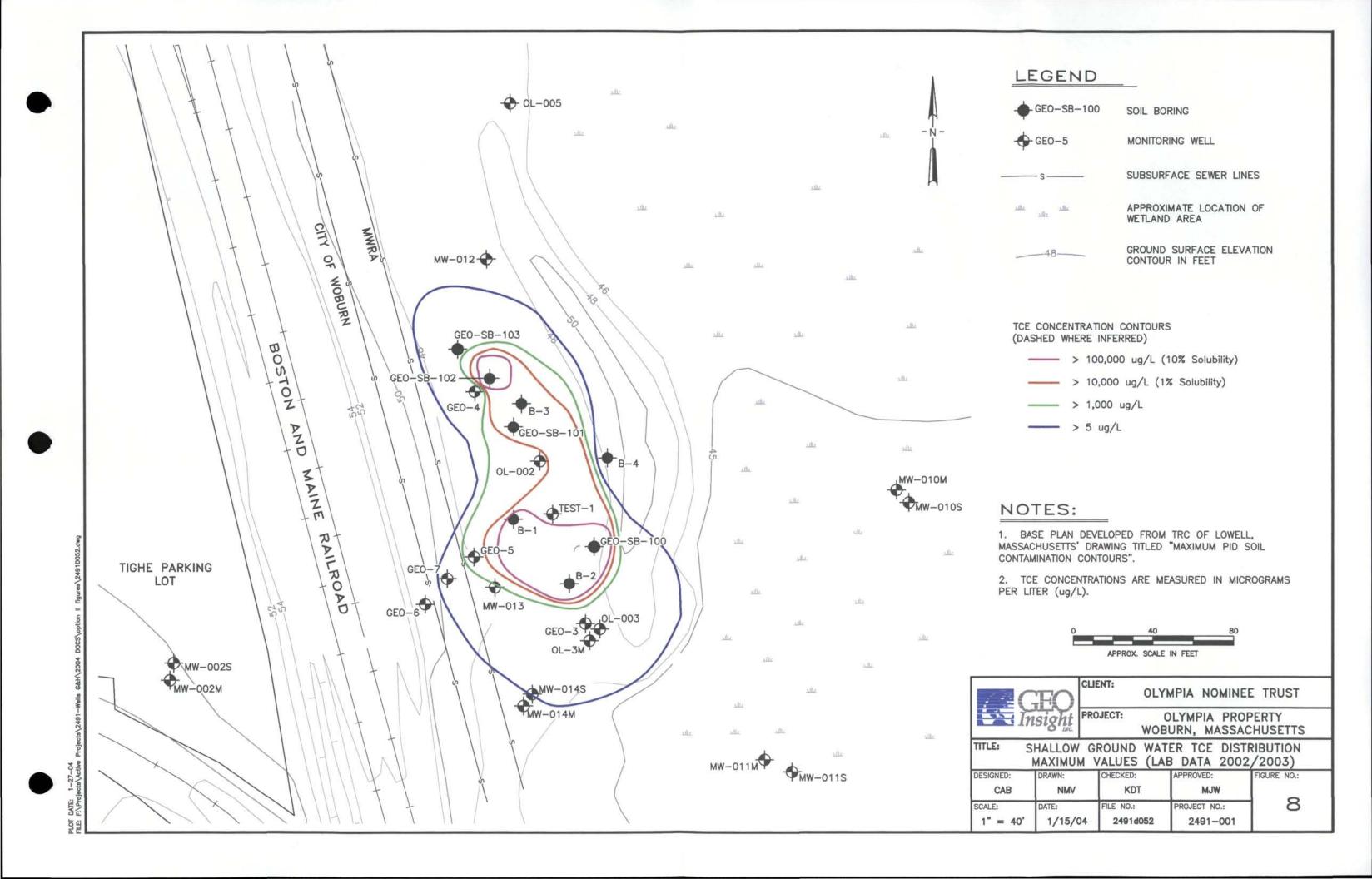
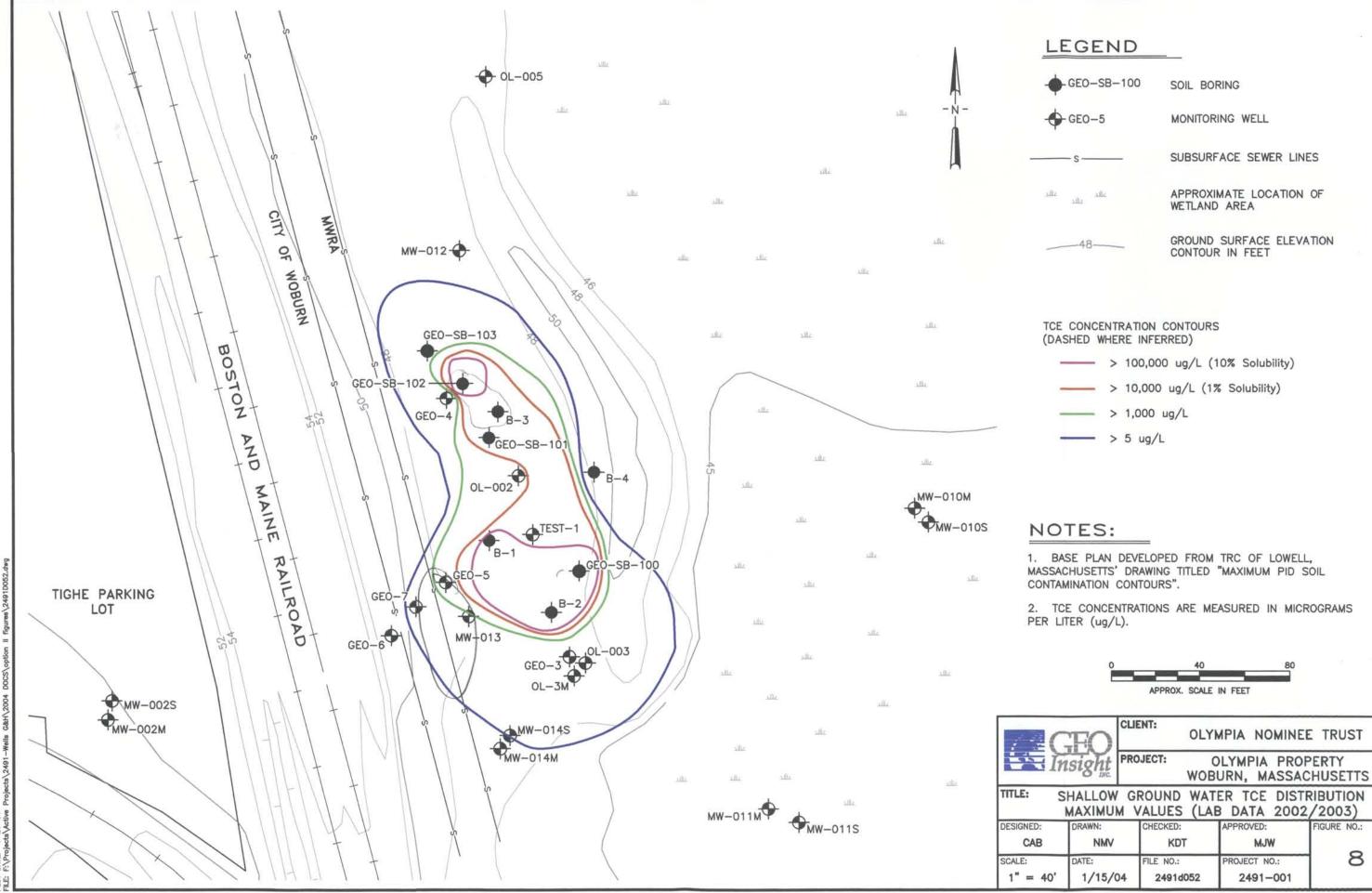
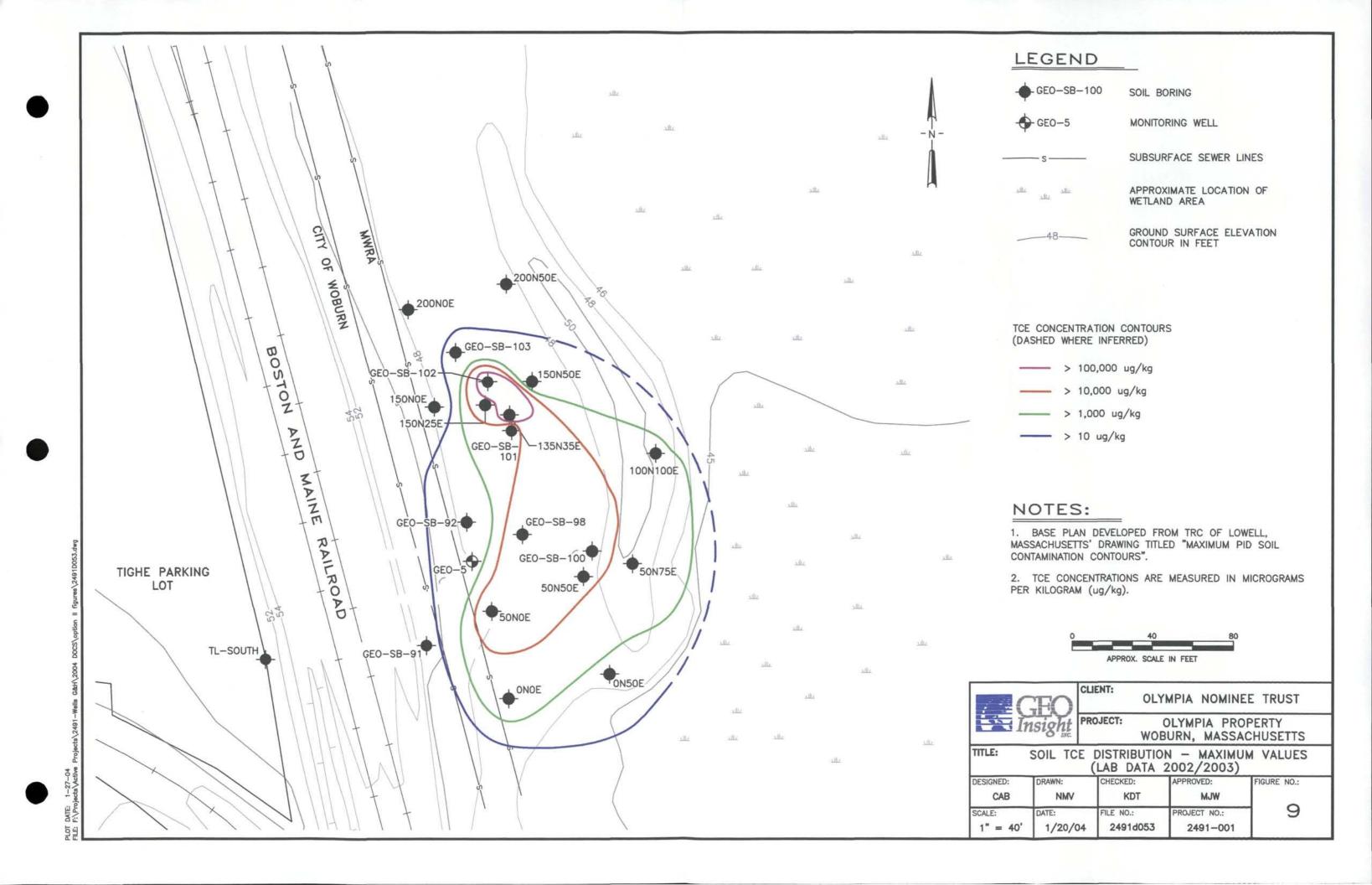


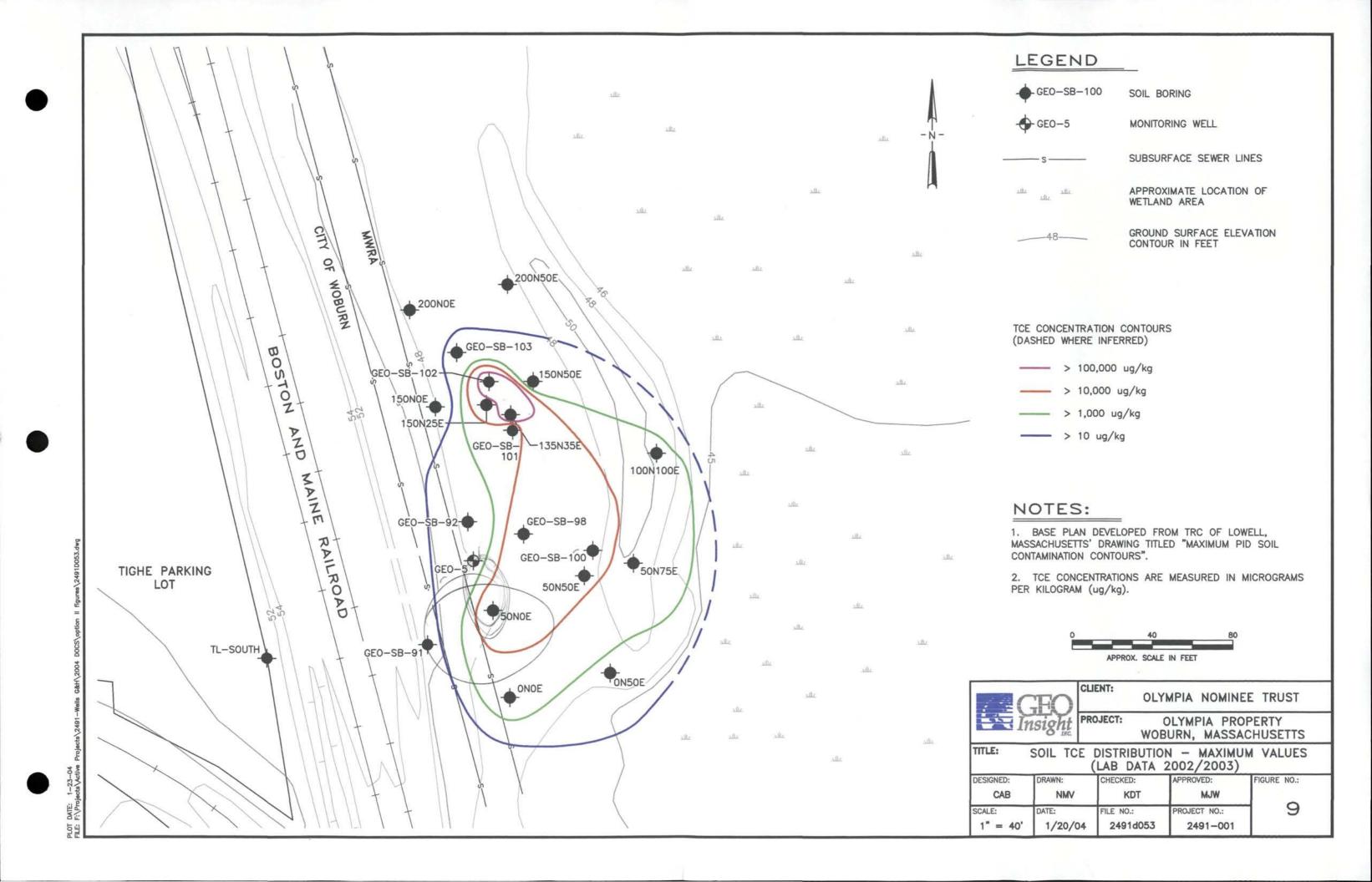
FIGURE NO .:

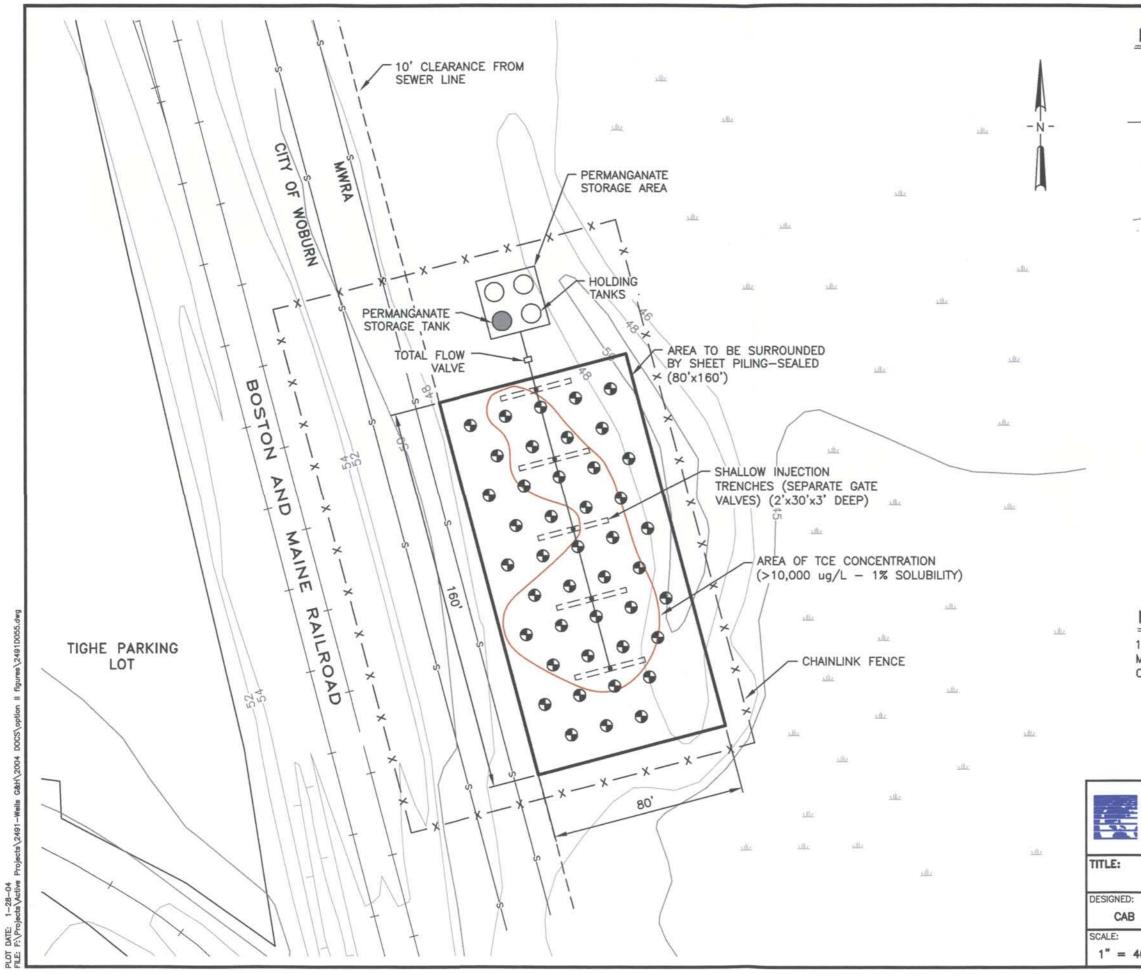
7











LEGEND

SUBSURFACE SEWER LINES

APPROXIMATE LOCATION OF WETLAND AREA

PROPOSED WELLS

GROUND SURFACE ELEVATION CONTOUR IN FEET

NOTES:

1. BASE PLAN DEVELOPED FROM TRC OF LOWELL, MASSACHUSETTS' DRAWING TITLED "MAXIMUM PID SOIL CONTAMINATION CONTOURS".





CLIENT:

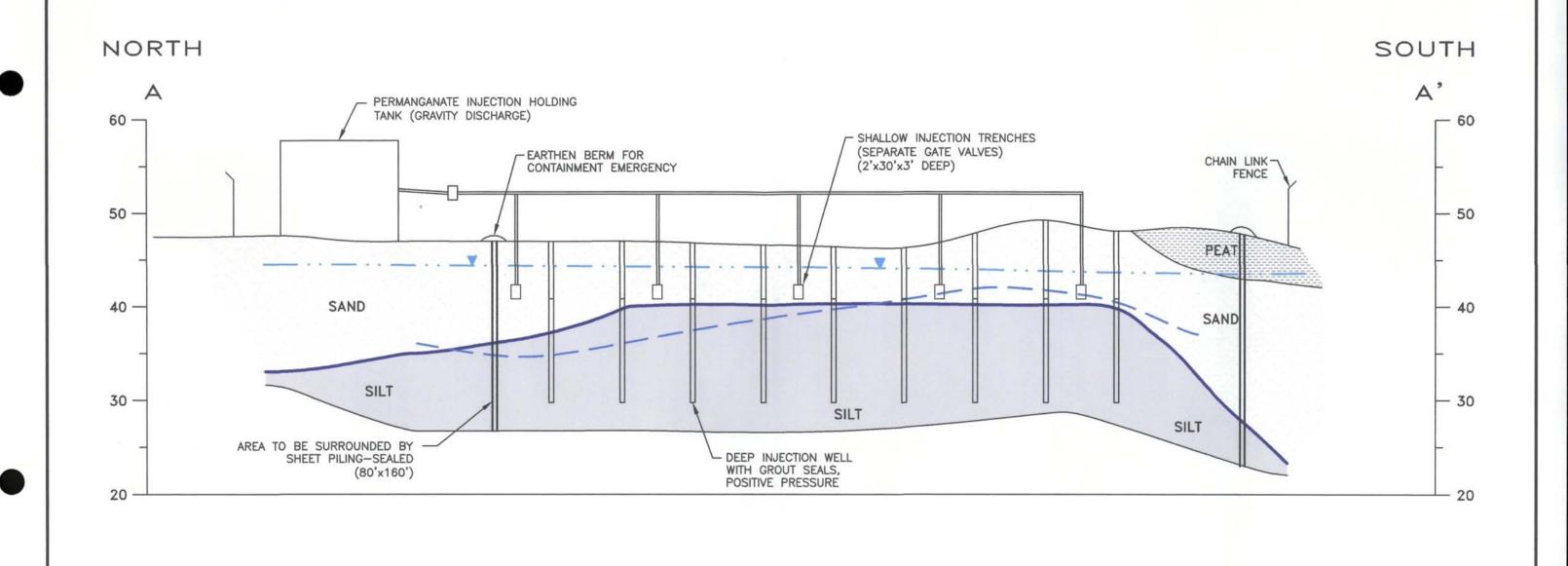
OLYMPIA NOMINEE TRUST

PROJECT:

OLYMPIA PROPERTY WOBURN, MASSACHUSETTS

ITLE:	PERM	IANGANATE	INJECTION	SYSTEM
		PLA	N VIEW	
ESIGNED:	DRAWN:	CHECKED:	APPROVED:	FIGUR

DESIGNED:	DRAWN:	CHECKED:	APPROVED:	FIGURE NO.:
CAB	NMV	KDT	MJW	
SCALE:	DATE:	FILE NO.:	PROJECT NO.:	10
1" = 40'	1/26/04	2491d055	2491-001	

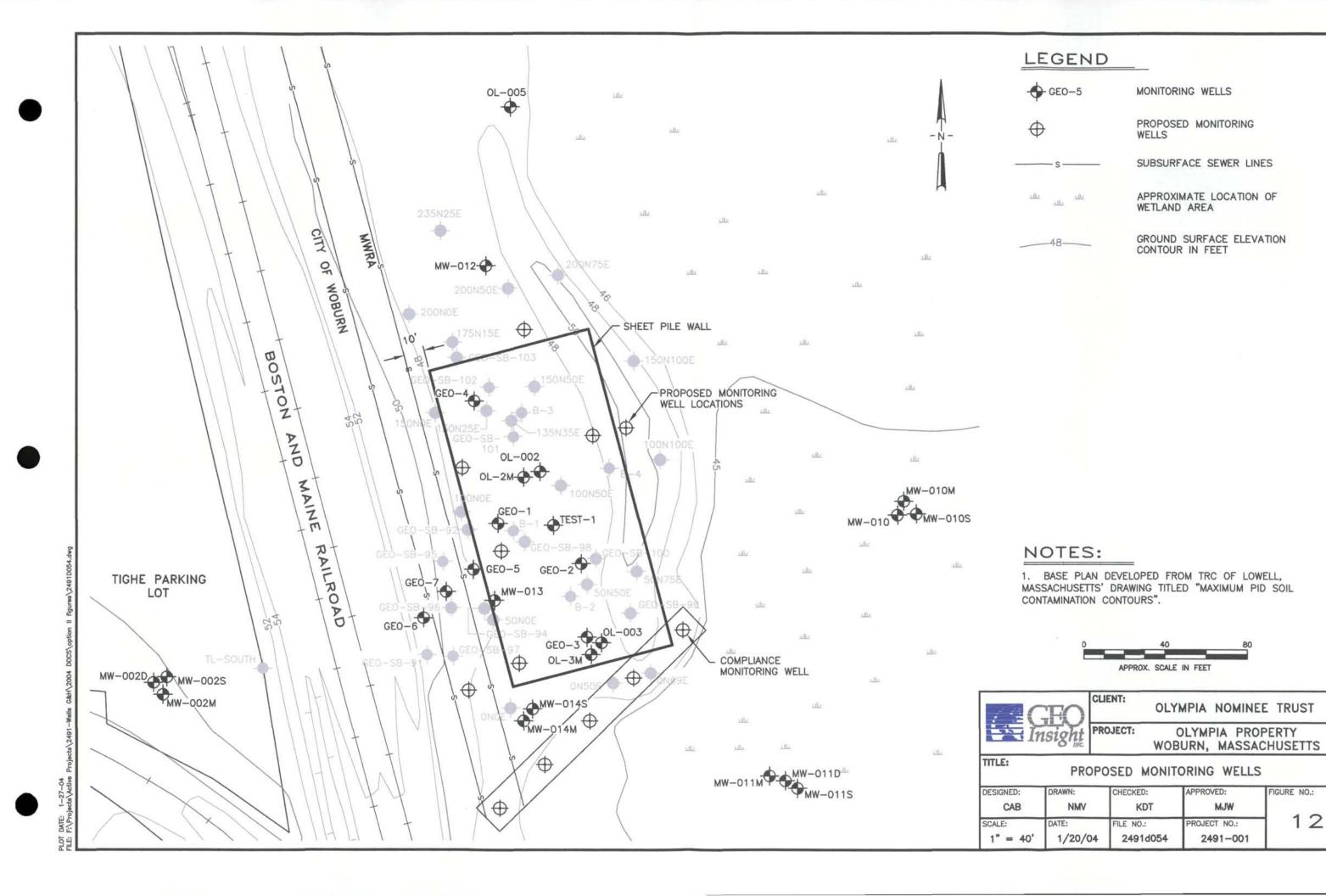


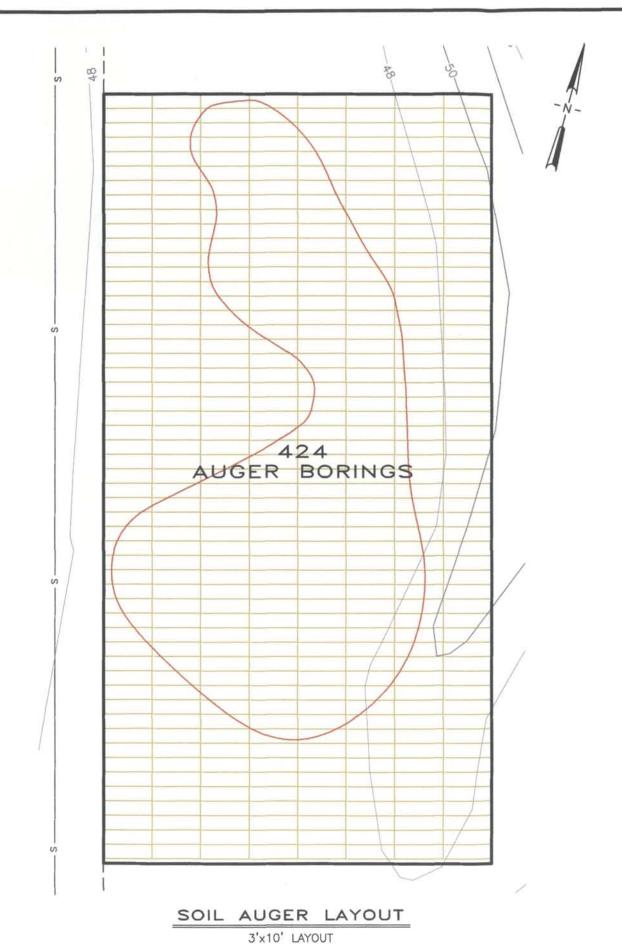


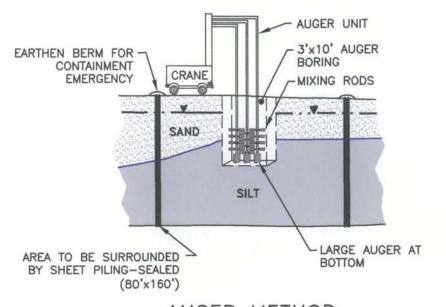
	THO	OLY	MPIA NOMINE	E TRUST		
= 17	sight PR		OLYMPIA PRO BURN, MASSA			
TITLE: PERMANGANATE INJECTION SYSTEM CROSS SECTION						
DESIGNED: NLJ	DRAWN: ESL/LR	CHECKED: CAB	APPROVED: CAB	FIGURE NO.:		
SCALE: AS SHOWN	DATE: 1/26/04	FILE NO.: 2491d058	PROJECT NO.: 2491-001	11		

E. F.\Projects\Active Projects\2491-Wells G&H\2004 DOCS\option II figures\249

LEGEND







AUGER METHOD

NOT TO SCALE

NOTES:

1. BASE PLAN DEVELOPED FROM TRC OF LOWELL, MASSACHUSETTS' DRAWING TITLED "MAXIMUM PID SOIL CONTAMINATION CONTOURS".





CLIENT:

OLYMPIA NOMINEE TRUST

OLYMPIA PROPERTY WOBURN, MASSACHUSETTS

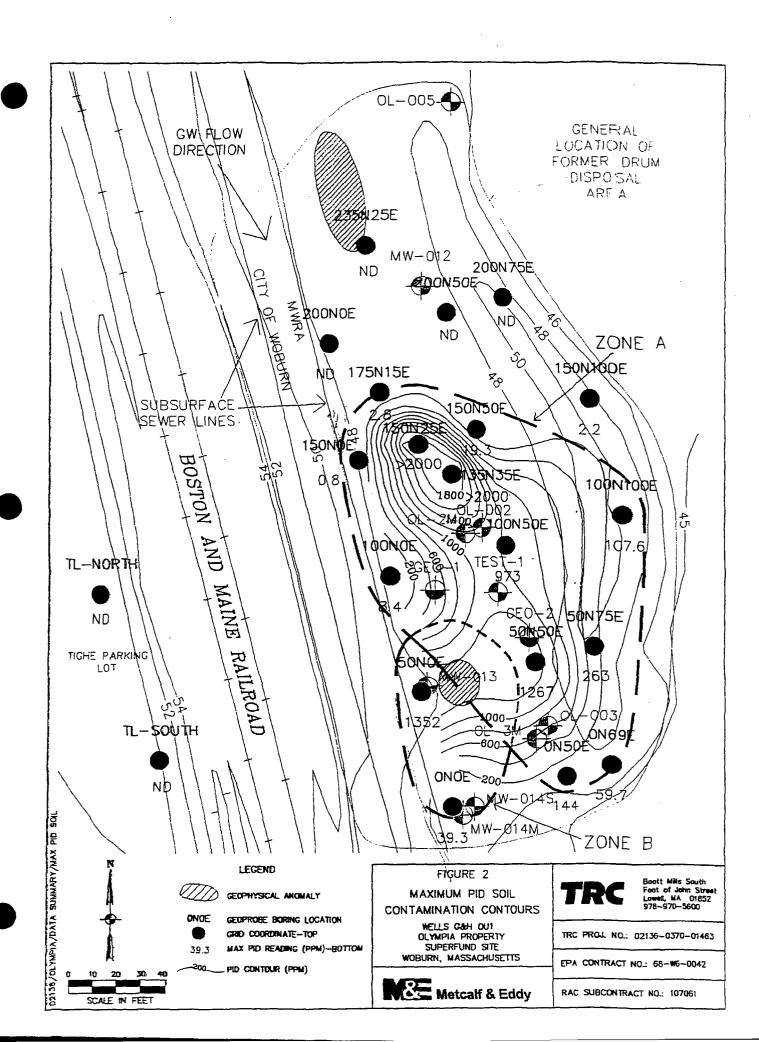
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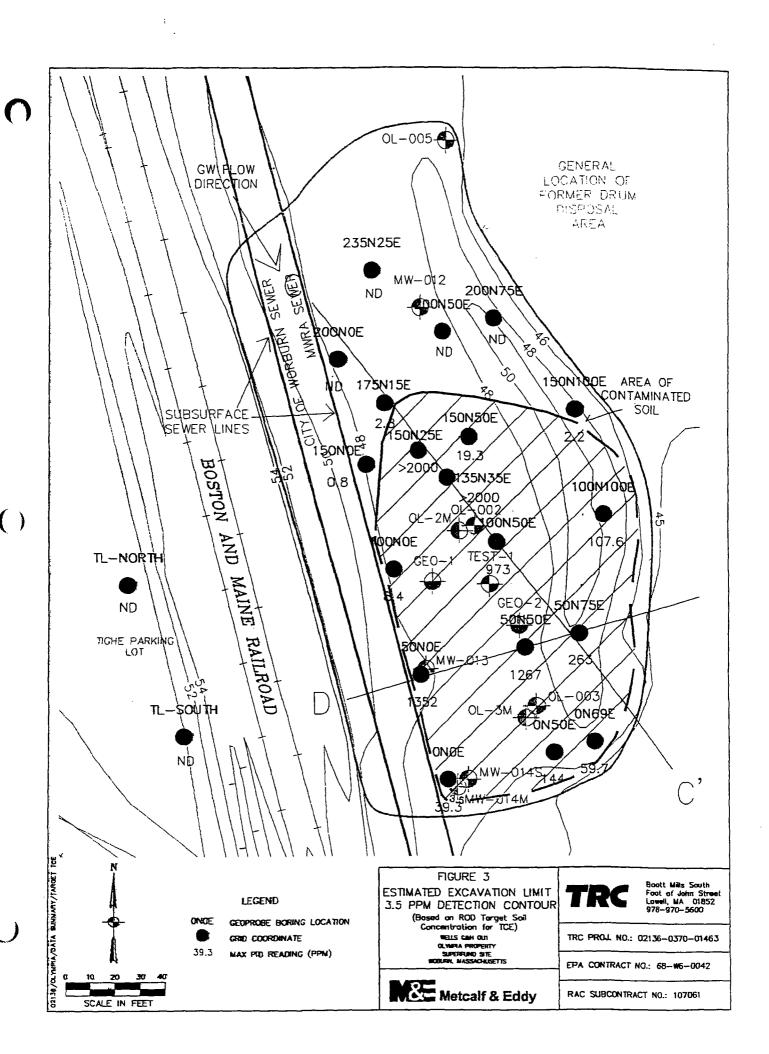
LAYOUT OF SOIL AUGER LOCATIONS PLAN VIEW

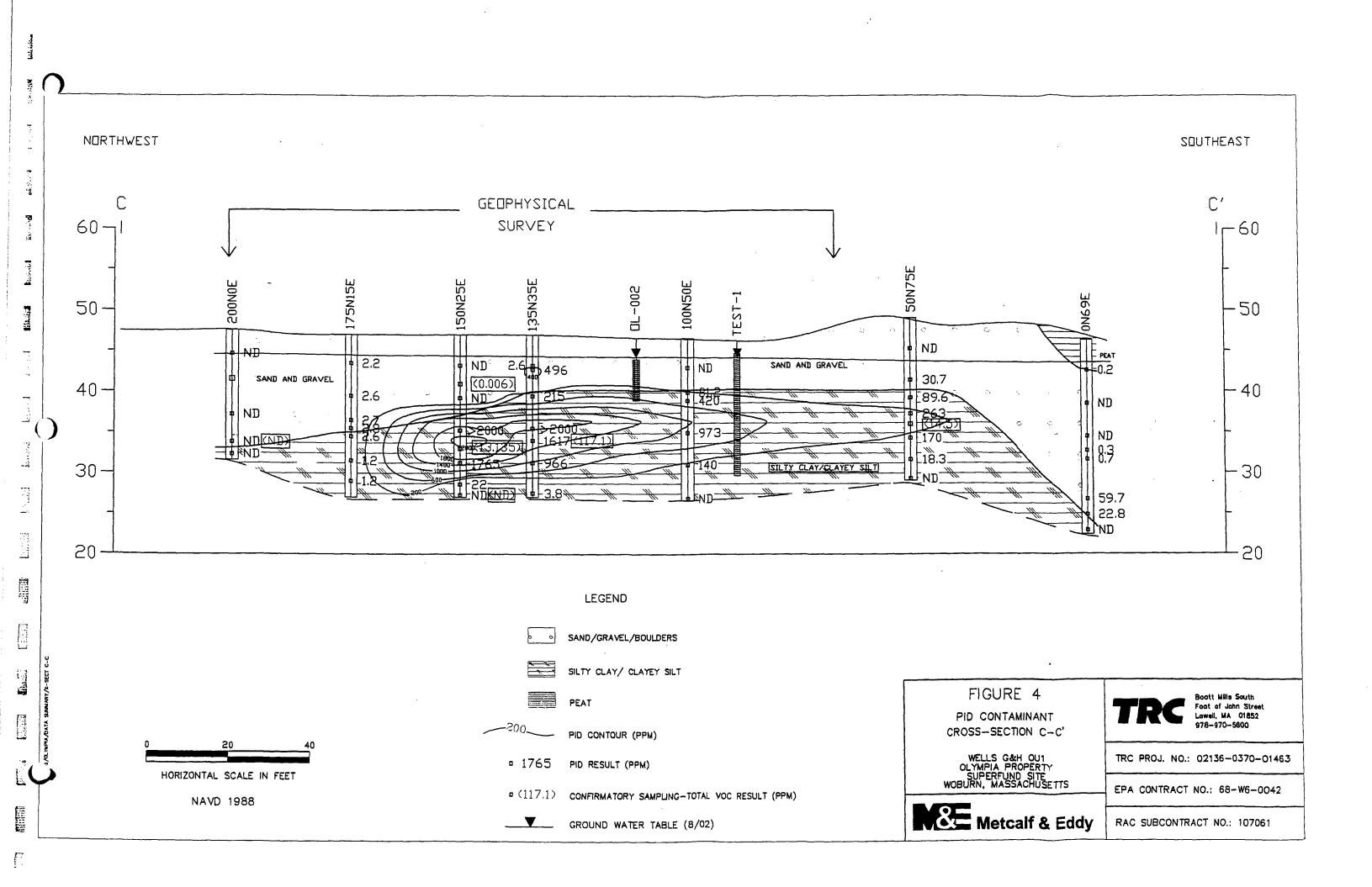
FIGURE NO .: DESIGNED: DRAWN: CHECKED: APPROVED: CAB NMV **KDT** MJW 13 SCALE: DATE: FILE NO.: PROJECT NO .: 1" = 20'2491-001 1/26/04 2491d055

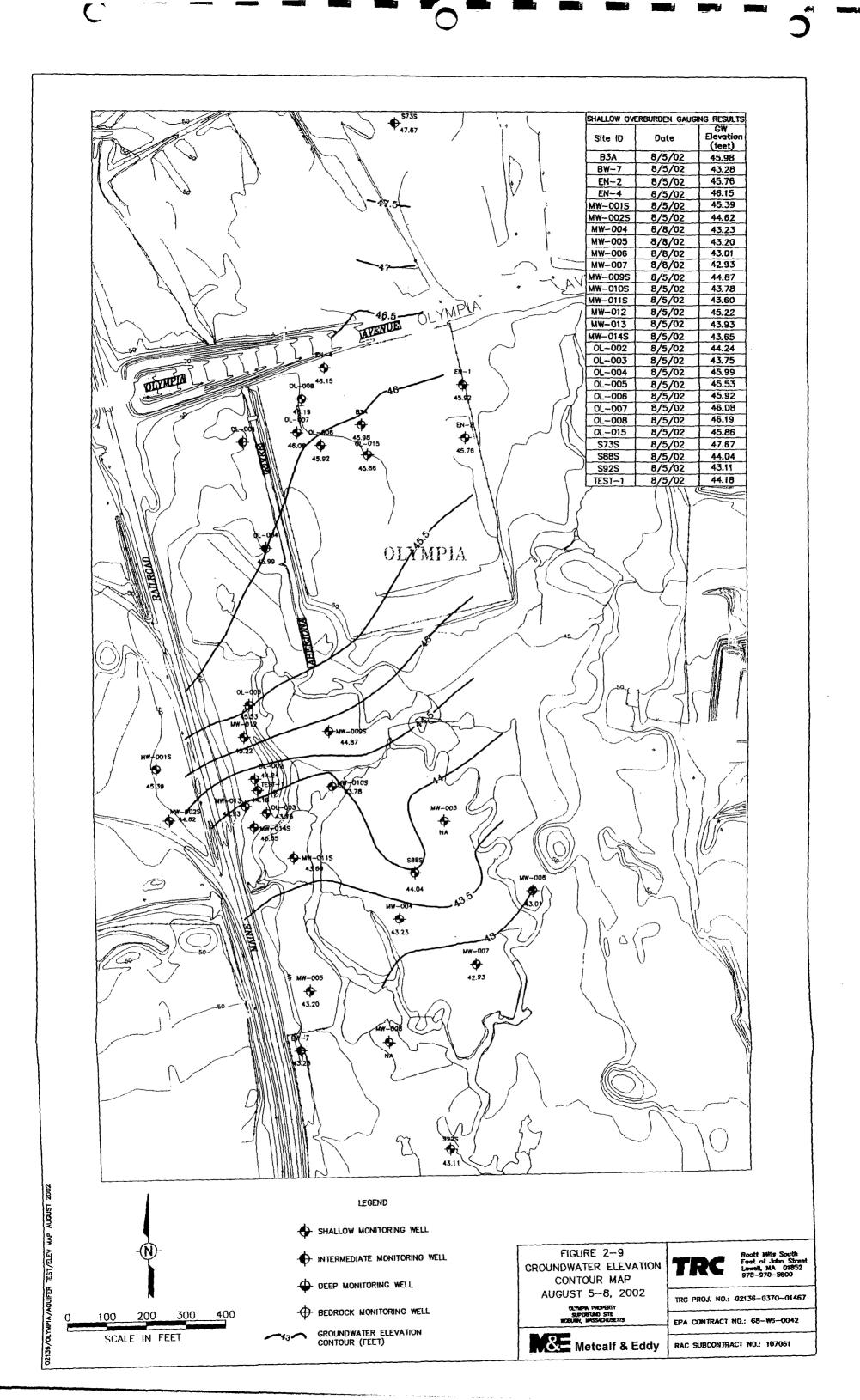


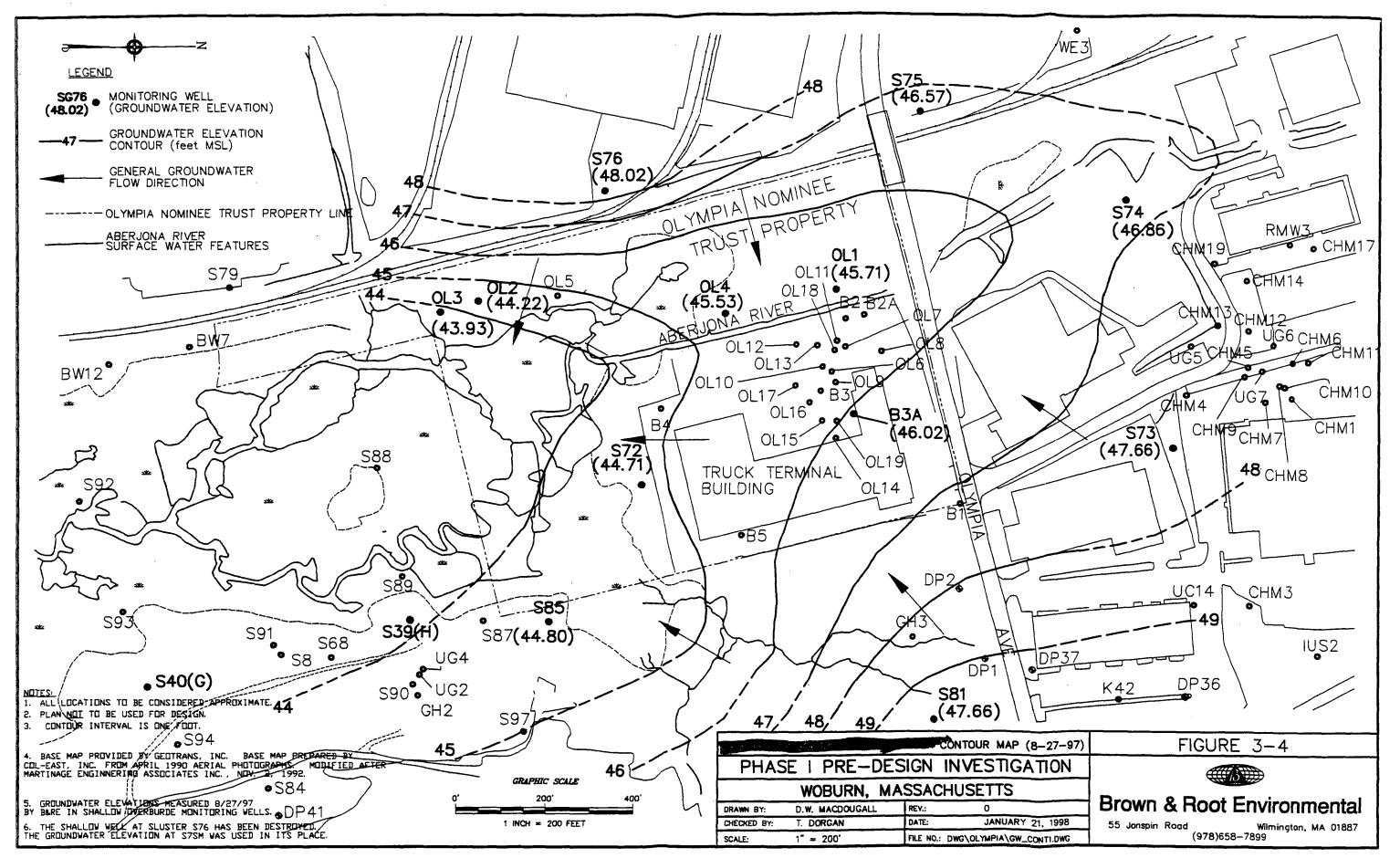
APPENDIX A Cross Sections and Maps (BRE and TRC)

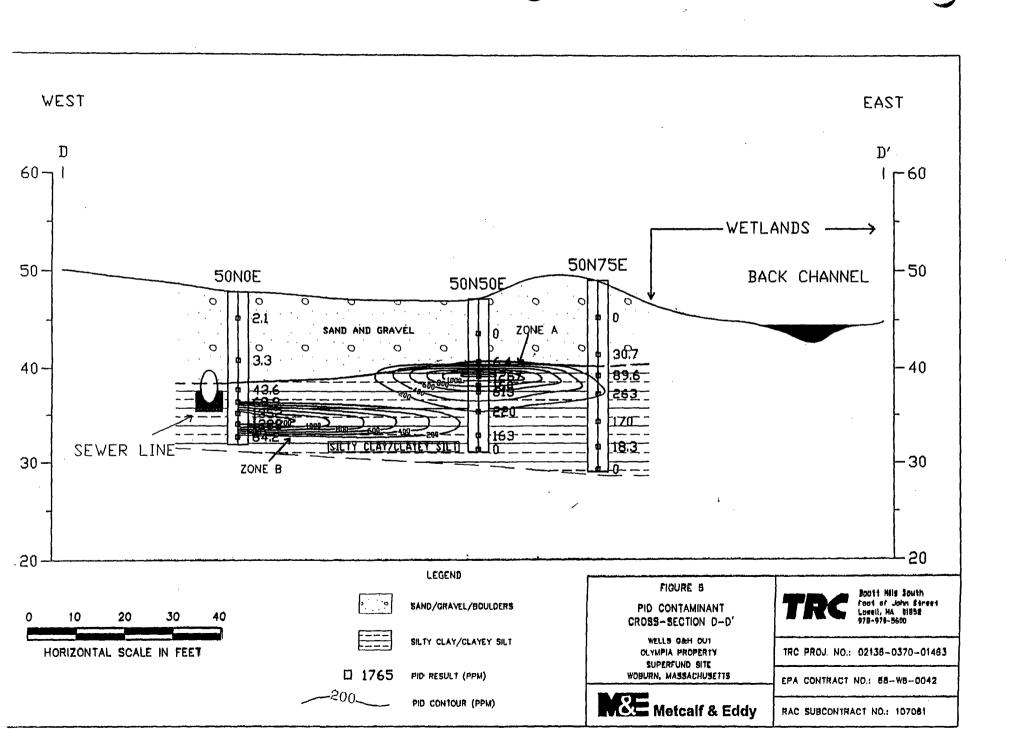












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APPENDIX B Soil Boring Logs - GeoInsight



SOIL BORING LOG

Boring No: Sheet: GEO-6 (GEO-SB-90)

CAB

. .

60 Olympia Avenue Woburn, Massachusetts Project Number: Chkd. By: ___ 0f: 2491-001

0.0

0.0

0.0

0.0

1

1

1

1

rilling Co.: Div

Diversified Environmental Resources

Project:

Location:

Boring Location:

Datum:

Foremar	n:		Alan St	ınaquist	Ground Surface Elevation:				Datum.	
Geolnsi	ght Eng.	./Geol:		Jared Sheeha	in	Date Started: _	06/12/2003	Date Completed: 06/12/03		
	DRILLING METHOD SAMPLER				GROUND WATER READINGS					
Vehicle:		GeoP	robe	Type:	Macro Core DATE DEPTH REFERENCE		REFERENCE	STABILIZATION		
Model:		Tru	ıck	Hammer(lb):		06/12/2003	~3'			
Method:				Fall (in):						
DEPTH		SA	AMPLE						FIELD	NOTE
(ft)	NO.	PEN/REC (in)	DEPTH (ft)	FEET		SAMPLE DESC	RIPTION		SCREENING (ppm)	
0			0-4		0" - 12" - Black OR	0" - 12" - Black ORGANIC MATERIAL, some fine				
					sand and gravel.					
					12" - 48" - Brown	fine SAND, some fir	ne gravel.			
	ĺ		l						ŀ	!

5

Tan SILT.

96" - 108" - Medium to coarse SAND and fine GRAVEL.

Brown fine to medium SAND, some fine gravel.

10 10-12 108" - 144" - Tan SILT.

4-6

6-8

8-10

14-16

0.0 1

0.0

0.0

12-14 144" - 168" - Tan fine SAND and SILT, some fine gravel.

15

168" - 192" - Tan SILT.

End of Boring @ 16'

GEO-6 installed @ 16' 1" diameter PVC riser 11', 1" slotted PVC 5'.

Concrete .5', sand 16'.

GRANULAR SOILS				COH	IESIVE SOILS	NOTES:
BLOWS/f	t.	DENSITY		BLOWS/ft.	CONSISTENCY	1. Soil sa
0-4	,	V. LOOSE		< 2	V. SOFT	metho
4-10		LOOSE		2-4	SOFT	2. Sample
_10-30	1	M. DENSE		4-8	M. STIFF	3. Sample
7-50		DENSE		8-15	STIFF	
>50		V. DENSE		15-30	V. STIFF	1
				>30	HARD	

- Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



DEPTH

(ft)

0-4

4-10

10-30

0-50

>50

V. LOOSE

M. DENSE

V. DENSE

LOOSE

DENSE

< 2

2-4

4-8

8-15

15-30 >30

SOIL BORING LOG

60 Olympia Avenue

Boring No:

Chkd. By:

GEO-SB-91

CAB

methods with a Thermo 580B PID equipped with an 11.6 eV lamp.

SOFT 2. Samples analyzed for Total Organic Carbon and Volatile Organics.

M. STIFF 3. Samples analyzed for Potassium Permanganate Demand.

Sheet:

Project Number:

Of: 2491-001

FIELD

SCREENING

NOTE

Woburn, Massachusetts Location:

Project:

FEET

SAMPLE

NO. PEN/REC DEPTH

Boring Location:

SAMPLE DESCRIPTION

Alan Sundquist Datum: **Ground Surface Elevation:** 06/12/2003 Date Completed: 06/12/03 Jared Sheehan Geolnsight Eng./Geol: Date Started:

GROUND WATER READINGS DRILLING METHOD SAMPLER Vehicle: DATE REFERENCE STABILIZATION GeoProbe Type: Macro Core DEPTH Model: Truck Hammer(lb): 06/12/2003 ~3' Method: Fall (in):

(11,)	NO.	(in)	(ft)	FEET	SAMPLE DESCRIPTION	(ppm)	
0			0-4		0 - 12" - Black ORGANIC MATERIAL, some fine	0.0	1
					sand and gravel.		
					12" - 48" - Brown fine SAND, some fine gravel.		
						0.0	1
1							
			4-6		48" - 72" - Brown fine to medium SAND, some fine gravel.	0.5	1
			4-6		146 - 72 - Brown line to medium SAND, some line graver.	0.5	<u>.</u>
5	-			<u>-</u>	-		
Ŭ							
			6-8		72" - 84" - Black fine to medium SAND.	0.0	1
					84" - 96" - Brown fine SAND and SILT.		
L			8-10		96" - 120" - Coarse SAND and fine GRAVEL, some fine	0.0	1
					sand.		
							<u> </u>
10			10-12		120" - 144" - Tan fine SAND and SILT.	0.0	1
			10 /2				
İ				.	1		
			12-16		144" - 192" - Tan fine SAND and SILT.	0.0	1,2
l						ļ	
				<u> </u>		<u> </u>	
						0.0	1
						0.0	<u> </u>
15				L			
					End of Boring @ 16'		
				<u> </u>		<u> </u>	
1			!	-			
		AR SOILS			HESIVE SOILS NOTES:		
BLOWS/1	ft.	DENSITY		BLOWS/ft.	CONSISTENCY 1. Soil samples screened in field for VOCs using jar h		

V. SOFT

STIFF

HARD

V. STIFF



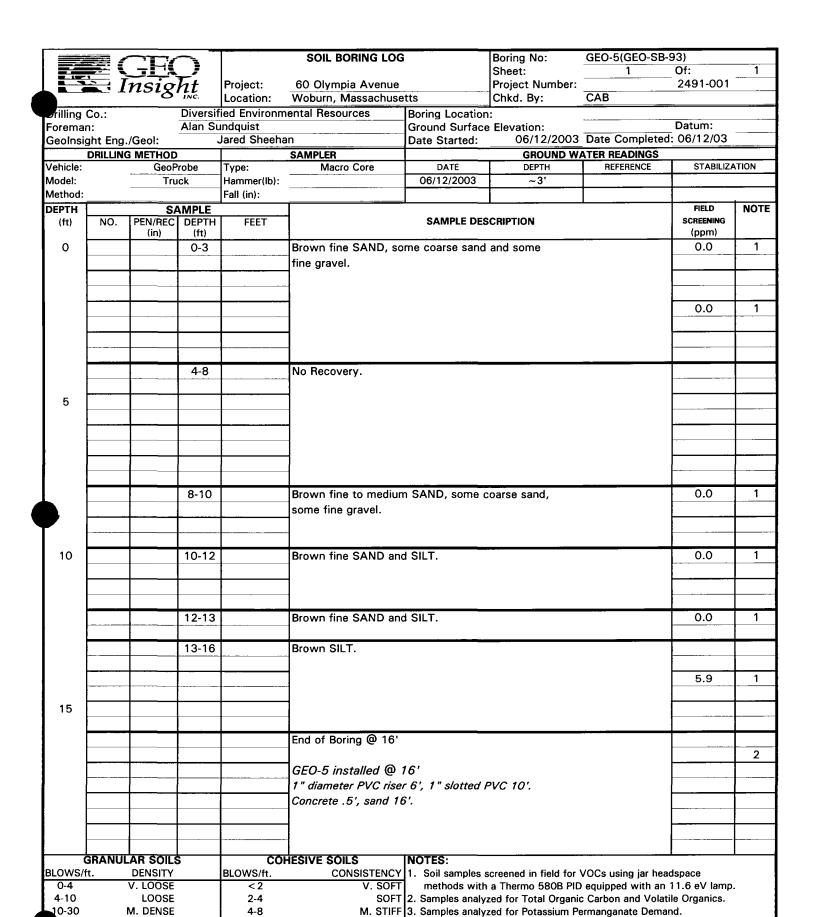
SOIL BORING LOG

GEO-SB-92 Boring No:

Of: Sheet: 60 Olympia Avenue Project Number: 2491-001 Project: Location: Woburn, Massachusetts Chkd. By: CAB filling Co.: **Diversified Environmental Resources Boring Location:** Alan Sundquist Ground Surface Elevation: Datum: Foreman: 06/12/2003 Date Completed: 06/12/03 Geolnsight Eng./Geol: Jared Sheehan Date Started: **DRILLING METHOD GROUND WATER READINGS** SAMPLER STABILIZATION Vehicle: GeoProbe Type: Macro Core DATE DEPTH REFERENCE 06/12/2003 Model: Truck Hammer(lb): ~3' Method: Fall (in): DEPTH FIELD NOTE SAMPLE NO. PEN/REC DEPTH FEET **SAMPLE DESCRIPTION SCREENING** (ft) (ft) (ppm) (in) 1 0-3 Brown grey fine SAND, some gravel. 0.0 0 0.0 1 4-8 Tan fine SAND and SILT. 0.0 1 5 0.0 1 8-12 Tan fine SAND and SILT. 0.0 1 10 0.0 1 12-16 Tan fine SAND and SILT. 0.0 1 8.7 1 15 End of Boring @ 16' 2 NOTES:

GRAI	NULAR SUILS	COHE	SIVE SOILS
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
_10-30	M. DENSE	4-8	M. STIFF
p-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

- 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



STIFF

HARD

V. STIFF

b-50

>50

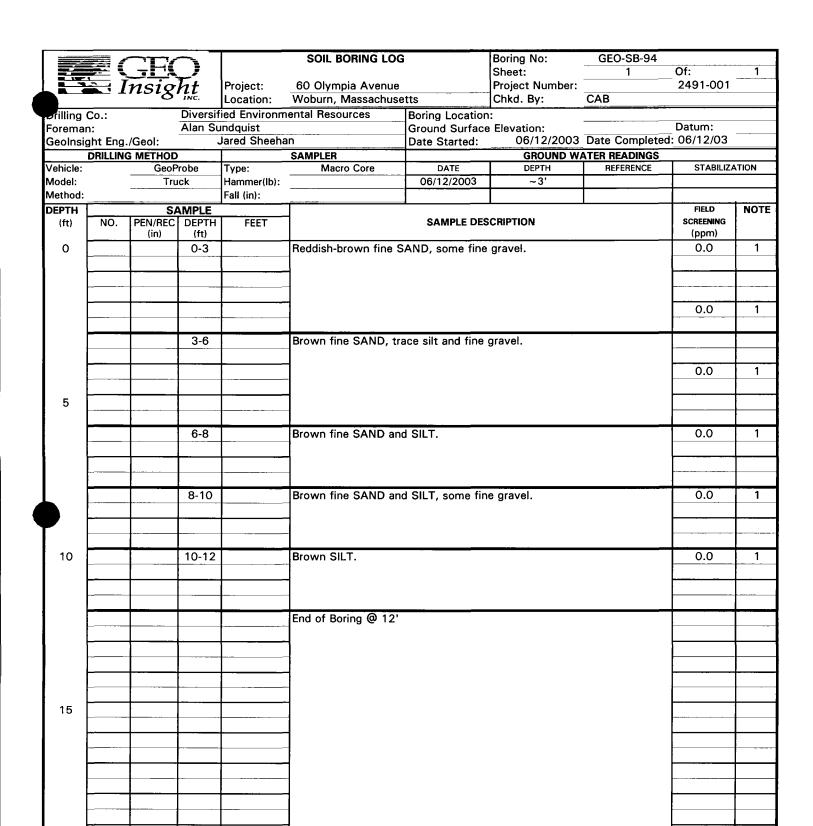
DENSE

V. DENSE

8-15

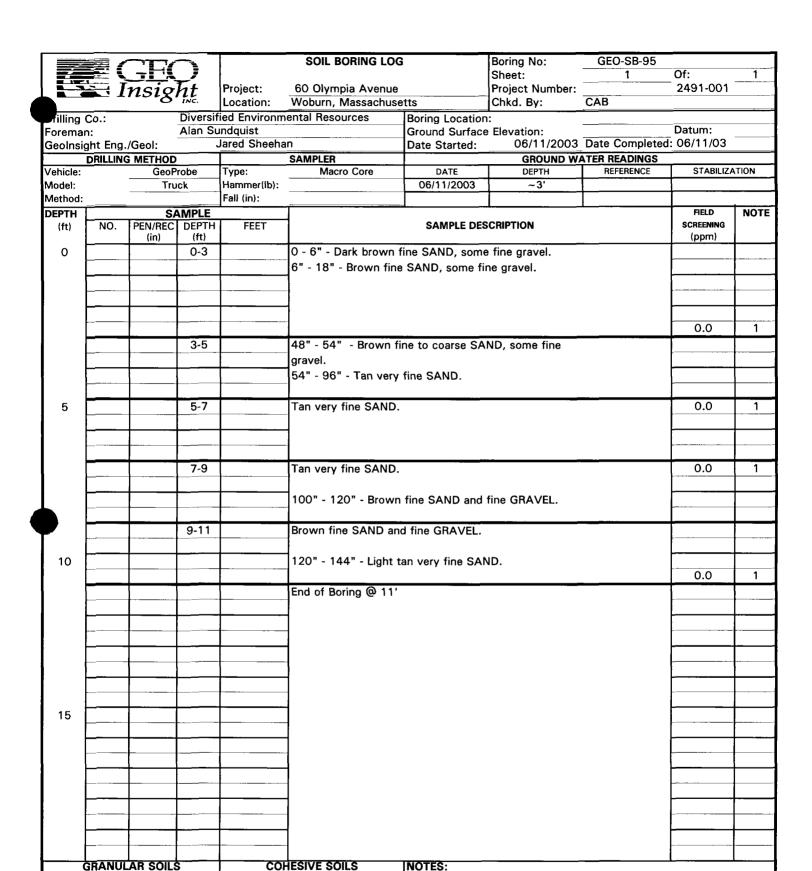
15-30

>30



GRANULAR SOILS		COHE	SIVE SOILS	NOTES:	
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY	1. Soil sa	
0-4	V. LOOSE	<2	V. SOFT	metho	
4-10	LOOSE	2-4	SOFT	2. Sample	
10-30	M. DENSE	4-8	M. STIFF	3. Sample	
0-50	DENSE	8-15	STIFF		
>50	V. DENSE	15-30	V. STIFF		
		>30	HARD		

- Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



NOTES:

STIFF

HARD

V. STIFF

CONSISTENCY 1. Soil samples screened in field for VOCs using jar headspace

M. STIFF 3. Samples analyzed for Potassium Permanganate Demand.

methods with a Thermo 580B PID equipped with an 11.6 eV lamp.

SOFT 2. Samples analyzed for Total Organic Carbon and Volatile Organics.

BLOWS/ft.

<2

2-4

4-8

8-15

15-30

>30

DENSITY

V. LOOSE

M. DENSE

V. DENSE

LOOSE

DENSE

BLOWS/ft. 0-4

4-10

10-30

p-50

>50



SOIL BORING LOG

Boring No:

GEO-SB-96

Sheet:

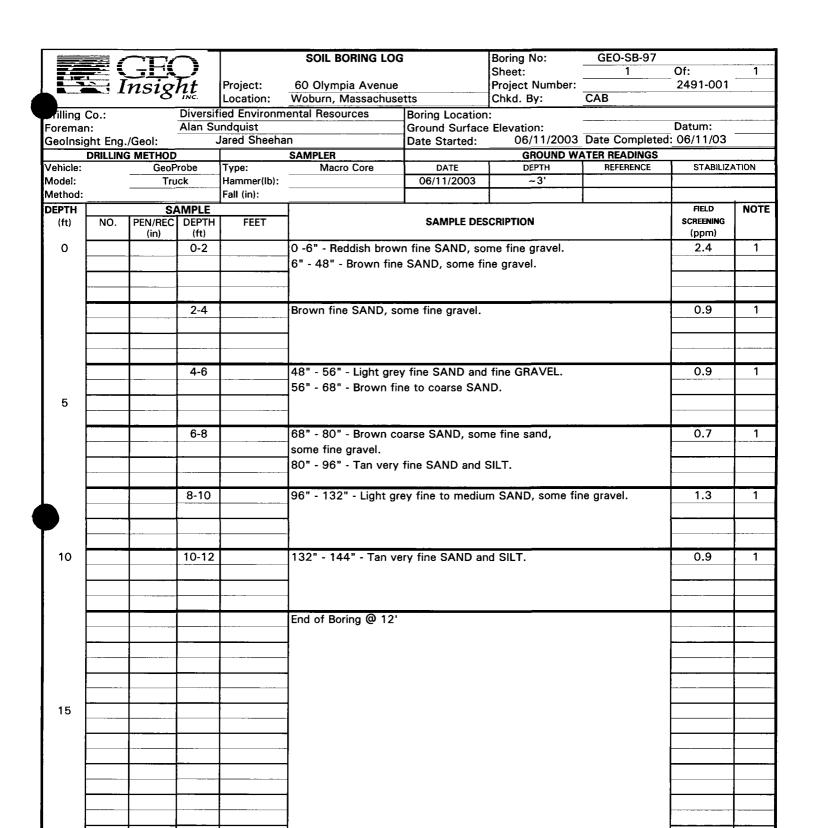
Of:

2491-001 Project: 60 Olympia Avenue Project Number: Location: Woburn, Massachusetts Chkd. By: CAB **Diversified Environmental Resources** rilling Co.: **Boring Location:** Foreman: Alan Sundquist **Ground Surface Elevation:** Datum: Jared Sheehan Date Started: 06/11/2003 Date Completed: 06/11/03 Geolnsight Eng./Geol: DRILLING METHOD **GROUND WATER READINGS** SAMPLER Vehicle: GeoProbe Type: Macro Core DATE DEPTH REFERENCE STABILIZATION 06/11/2003 Model: Truck Hammer(lb): ~3' Method: Fall (in): SAMPLE DEPTH STRATUM FIELD NOTE PEN/REC DEPTH SCREENING NO. SAMPLE DESCRIPTION DESCRIPTION (ft) FEET (ft) (in) (ppm) 0-2 0 - 6" - Black-brown fine SAND, some fine gravel. 0.0 1 0 6" - 48" - Brown fine SAND, some fine gravel. Brown fine SAND, some fine gravel. 0.0 1 2-4 4-6 48" - 60" - Brown fine to medium SAND, some 0.0 1 fine gravel. 60" - 72" - Blackish-brown fine to medium SAND, 5 some fine gravel. 72" - 84" - Tan very fine SAND and SILT. 6-8 1.9 1 84" - 116" - Brown fine to coarse SAND, some fine gravel. 8-10 Brown fine to coarse SAND, some fine gravel. 0.2 1 10 10-12 116" - 144" - Tan very fine SAND and SILT. 0.4 1 End of Boring @ 12' 15

NOTES:

GRA	NULAR SOILS	COHES	SIVE SOILS
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
p-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

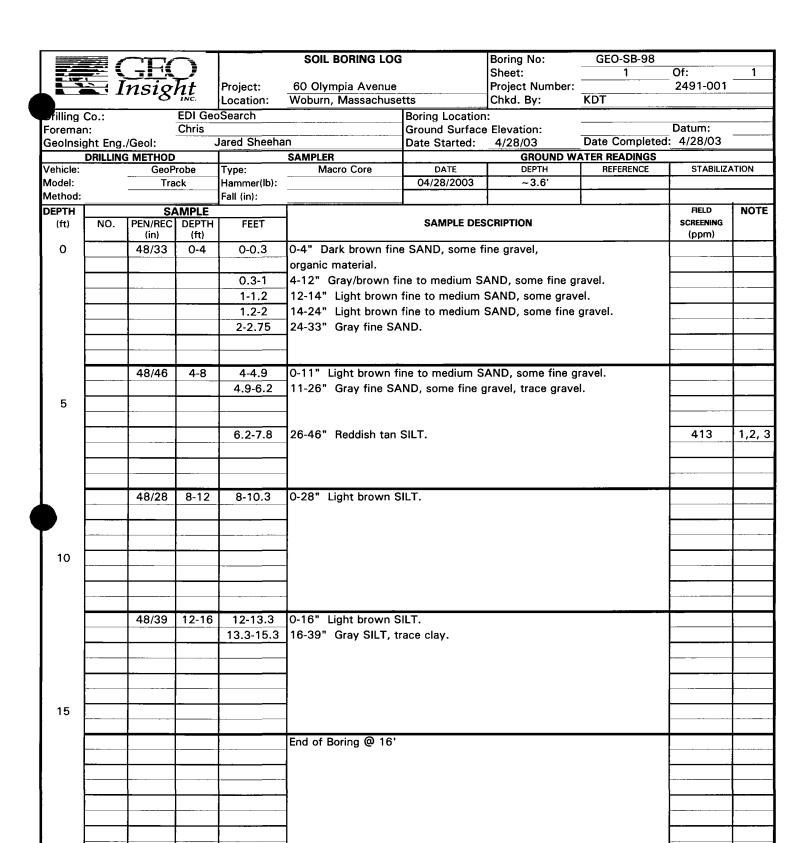
- 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



NOTES:

GRANULAR SOILS COHESIVE SOILS BLOWS/ft. DENSITY BLOWS/ft. 0-4 V. LOOSE < 2 4-10 LOOSE 2-4 10-30 M. DENSE 4-8 **D**-50 DENSE 8-15 STIFF V. DENSE 15-30 V. STIFF HARD >30

- CONSISTENCY 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
 - SOFT 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
 - M. STIFF 3. Samples analyzed for Potassium Permanganate Demand.



GRA	NULAR SOILS	COHE	SIVE SOILS	NOTES:
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY	1. Soil sa
0-4	V. LOOSE	<2	V. SOFT	metho:
4-10	LOOSE	2-4	SOFT	2. Sample
10-30	M. DENSE	4-8	M. STIFF	3. Sample
D-50	DENSE	8-15	STIFF	
>50	V. DENSE	15-30	V. STIFF	
		>30	HARD	l

- Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



Boring No:

GEO-SB-99

Sheet:

Of: 2491-001

Project: Location:

60 Olympia Avenue Woburn, Massachusetts Project Number: KDT Chkd. By:

rilling Co.: Foreman:

EDI GeoSearch

Chris Jared Sheehan

Boring Location: Ground Surface Elevation: Date Started: 4/28/03

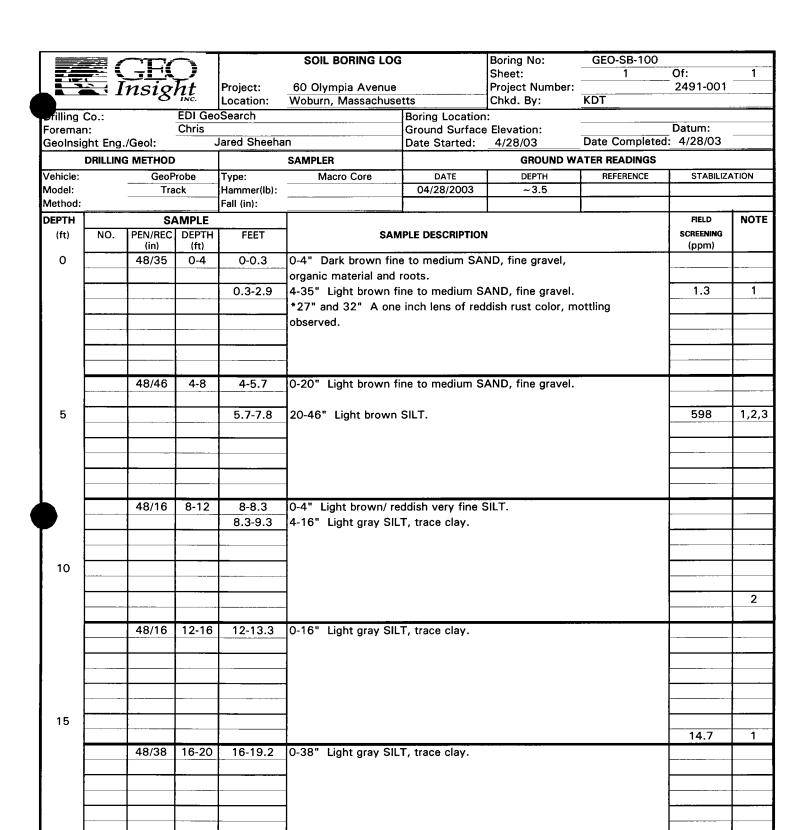
Datum: Date Completed: 4/28/03

Geolnsight En	g./Geol:	Jared Sheehan	<u> </u>	Date Started:	4/28/03	Date Completed	4/28/03
DRILLII	NG METHOD		SAMPLER		GROUNE	WATER READINGS	
Vehicle:	GeoProbe	Туре:	Macro Core	DATE	DEPTH	REFERENCE	STABILIZATION
Model:	Track	Hammer(lb):		04/28/2003	~5'	·	
Mathadi							- "

Method:				Fall (in):			
DEPTH		SA	AMPLE			FIELD	NOTE
(ft)	NO.	PEN/REC (in)	DEPTH (ft)	FEET	SAMPLE DESCRIPTION	SCREENING (ppm)	
0		48/31	0-4	0-0.4	0-5" Dark brown ORGANIC MATERIAL and ROOTS.		
				0.4-1.5	5-18" Dark brown fine SAND, some coarse sand,		
					some fine gravel.		
				1.5	18" Tan fine SAND and SILT.		
				1.5-1.9	18-23" Brown fine to medium SAND and SILT.		
				1.9-2.6	23-31" PEAT.		
							3
		48/31	4-8	4-4.7	0-8" Dark brown fine SAND, some medium sand and silt.		3
		10,01	' '	4.7-5.1	8-13" Medium brown fine to medium SAND, some	0	1,3
5					coarse sand and gravel, some silt.		- , -
				5.1-6.6	13-31" Light brown fine to coarse SAND, some fine gravel,	-	
					1		
					1	-	
					End of Boring @ 8'		
			-]		
10							
Ì							
	<u> </u>						
	<u> </u>						ļ
15							
	<u> </u>		_				<u> </u>
							-
		_			-		
					-		
				<u> </u>			
				Ļ.	<u> </u>		<u> </u>

GRAI	NULAR SOILS	COHES	SIVE SOILS
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
0-30	M. DENSE	4-8	M. STIFF
- 30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

- NOTES: 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



	GRANULA	AR SOILS	COHESIVE	SOILS	NOTES:
BLO	WS/ft. I	DENSITY	BLOWS/ft.	CONSISTENCY	Soil samples screened in field for VOCs using jar headspace
0	-4 V	'. LOOSE	<2	V. SOFT	methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
4	10	LOOSE	2-4	SOFT	2. Samples analyzed for Total Organic Carbon and Volatile Organics.
•		I. DENSE	4-8	M. STIFF	3. Samples analyzed for Potassium Permanganate Demand.
30	-50	DENSE	8-15	STIFF	
>	50 V	. DENSE	15-30	V. STIFF	
			>30	HARD	

End of Boring @ 20'



Boring No:

Chkd. By:

4/28/03

GEO-SB-101

KDT

Project: Location:

60 Olympia Avenue
Woburn, Massachusetts

Sheet: Project Number: Of: 2491-001

rilling Co.: Foreman:

Geolnsight Eng./Geol:

EDI GeoSearch

Chris

Jared Sheehan

Boring Location: Ground Surface Elevation:

Date Started:

Datum:
Date Completed: 4/28/03

DRILLING METHOD		SAMPLER		GROUND WATER READINGS				
Vehicle:	GeoProbe	Туре:	Macro Core	DATE	DEPTH	REFERENCE	STABILIZATION	
Model:	Track	Hammer(lb):		04/28/2003	~3.5			
Method:		Fall (in):					-	

DEPTH		SA	AMPLE			FIELD	NOTE
(ft)	NO.	PEN/REC (in)	DEPTH (ft)	FEET	SAMPLE DESCRIPTION		
0		48/34	0-4	0-0.4	0-5" Dark brown fine SAND, some fine gravel,		
					and organic material.		
				0.4-2.8	5-34" Fine to coarse SAND, some fine gravel.		
							1
							-
						4.1	1
		48/46	4-8	4-6	0-25" Light brown fine to medium SAND, some fine gravel,		
					gravel.		
5							
				0.00	OF OTH Court fire CAND come site and fire around	401	1
				6-6.3 6.3-7.8	25-27" Gray fine SAND, some silt and fine gravel. 27-46" Light brown fine SAND.	491	1
				0.3-7.0	27-40 Light blown thie SAND.		
		48/31	8-12	8-9.3	0-16" Light brown fine to medium SAND, some fine		
					gravel.		
	-			9.3-10.3	16-28" Gray/brown fine to medium SAND, some gravel and silt.		
10				10.3-10.6	28-31" Light brown SILT.		2
, ,				10.0 10.0	Light brown oiet.		
İ							
		48/35	12-16	12-12.8	0-9" Light brown fine to medium SAND, some fine gravel.		
				12.8-14.8	9-34" Light brown SILT, trace coarse sand.	<u> </u>	
				14.8-14.9] 34-35" Light gray SILT, trace clay.		
15							2,3
							L
		48/43	16-20	16-16.5	0-6" Light brown fine to medium SAND, some fine gravel.		
				16.5-18.3	6-27" Light brown SILT, some medium to coarse sand.		
				_			
				18.3-19.4	27-41" Light brown SILT.	690	1,2,3
				19.4-19.6	41-43" Gray SILT, trace clay.		
					End of Boring @ 20'		
	GRANIII	AR SOILS	3	COL	HESIVE SOILS INOTES:		

GRA	NULAR SOILS	COHE	SIVE SOILS
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
b-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

- NOTES:

 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



Boring No: Sheet:

GEO-SB-102

KDT

Of:

Project: Location:

60 Olympia Avenue Woburn, Massachusetts Project Number: Chkd. By:

2491-001

FIELD

NOTE

Foreman:

DEPTH

EDI GeoSearch

SAMPLE

Boring Location:

Ground Surface Elevation:

Datum:

Geolnsight Eng./Geol:

Jared Sheehan

Date Completed: 4/25/03 Date Started: 4/25/03

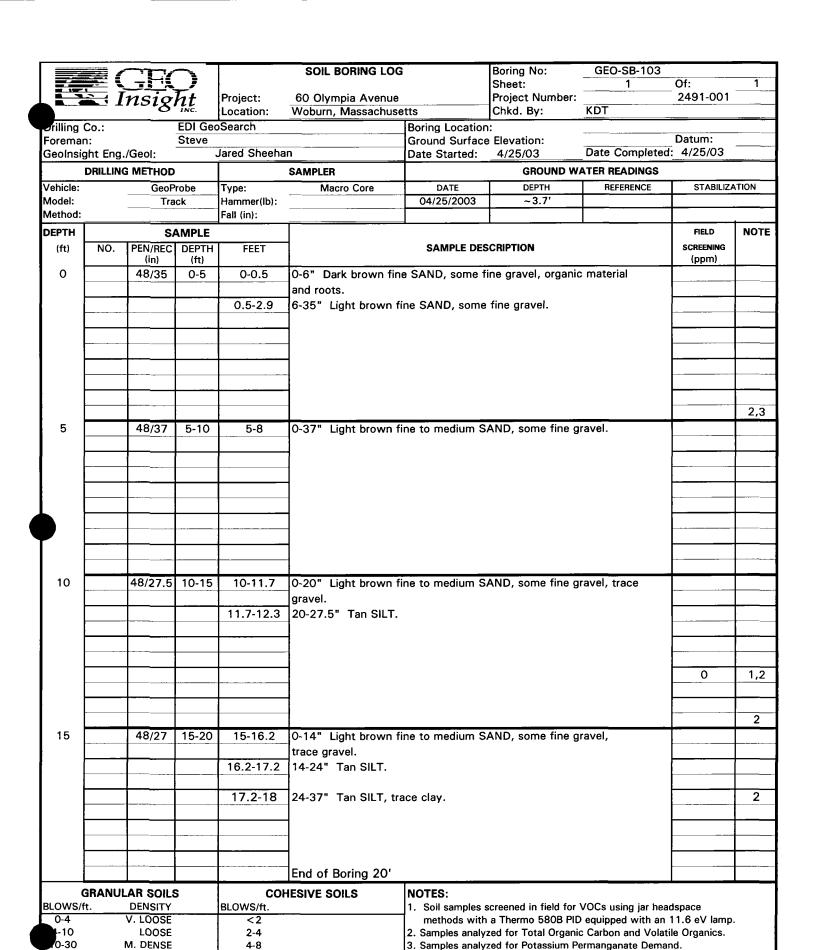
GROUND WATER READINGS DRILLING METHOD SAMPLER STABILIZATION Vehicle: Macro Core DATE DEPTH REFERENCE GeoProbe Type: 04/25/2003 Model: Hammer(lb): ~4.2 Track Method: Fall (in):

JE:			AIAIL FF				
(ft)	NO.	PEN/REC (in)	DEPTH (ft)	FEET	SAMPLE DESCRIPTION	SCREENING (ppm)	
0		48/17	0-5	0-0.3	0-4" Dark brown fine SAND, trace fine gravel and organic material.		
				0.4-0.5	6-17" Light brown fine to coarse SAND, trace fine gravel.		
				0.5-1.4			
5		48/31	5-10	5-7.6	0-31" Light brown fine to coarse SAND, some fine gravel.		
						<u></u>	
				••			
	1					f	
10		48/41	10-15	10-13.5	0-18" Light brown fine to coarse SAND, some fine gravel.		
	- I						
				13.5-14.4	18-41" Light brown/gray/red SILT.		
							2
			-		1		
							2
15		48/58	15-20	15-1 <mark>6.8</mark>	0-19" Light brown fine to coarse SAND, some fine gravel.		
						504	1
	1			16.8-18.6	19-43" Light brown SILT.		
	•						
				18.6-19.8	43-58" Gray SILT, trace clay.		
							2,3
					End of Boring @ 20'	<u> </u>	<u> </u>

GRA GRA	NULAR SOILS	COHESIVE SOILS	
BLOWS/ft.	DENSITY	BLOWS/ft.	
0-4	V. LOOSE	<2	
4-10	LOOSE	2-4	
0-30	M. DENSE	4-8	
30-50	DENSE	8-15	
>50	V. DENSE	15-30	
}		>30	

NOTES:

- 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



30-50

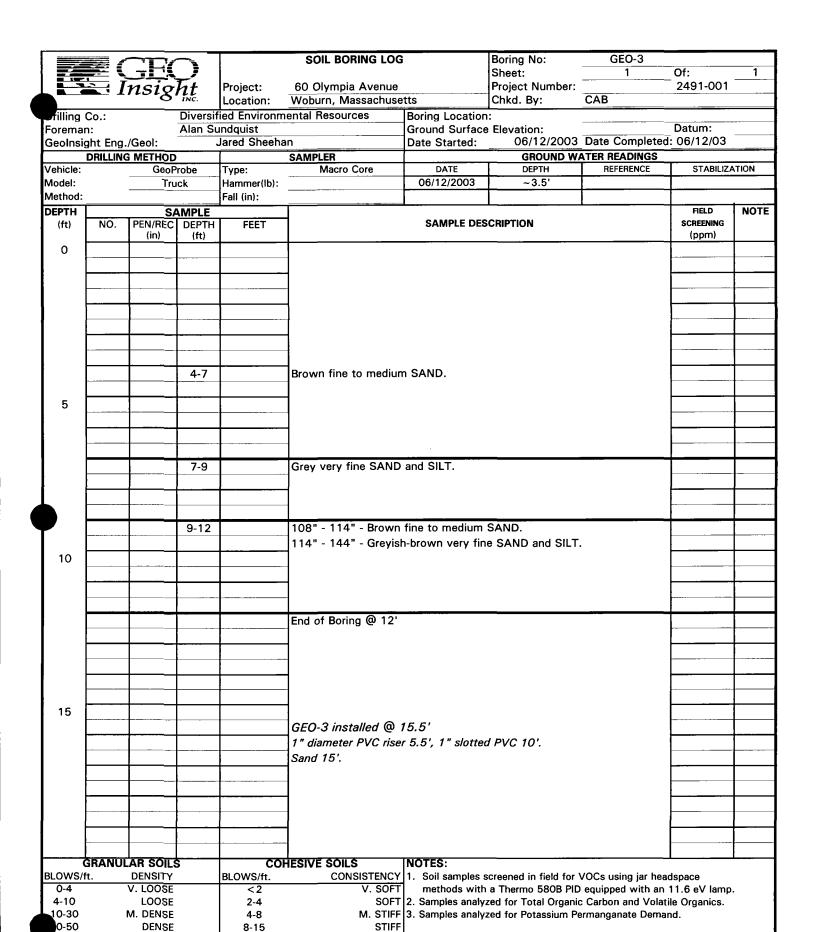
>50

DENSE

V. DENSE

8-15

15-30 >30



V. STIFF

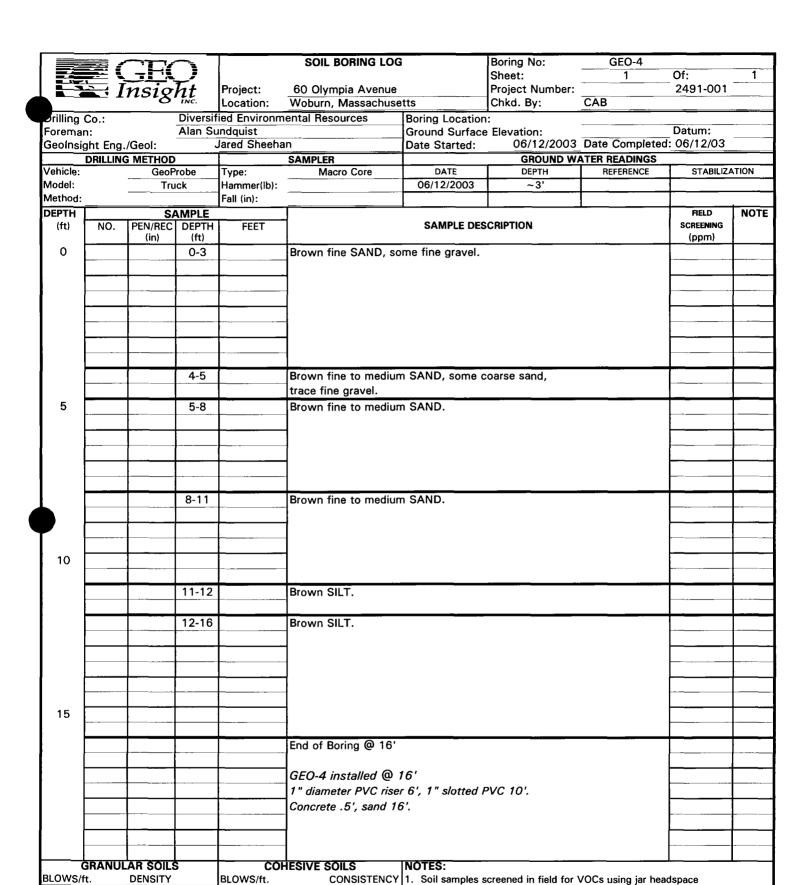
HARD

>50

V. DENSE

15-30

>30



V. SOFT

STIFF

HARD

V. STIFF

methods with a Thermo 580B PID equipped with an 11.6 eV lamp.

SOFT 2. Samples analyzed for Total Organic Carbon and Volatile Organics.

M. STIFF 3. Samples analyzed for Potassium Permanganate Demand.

0-4

4-10

10-30

D-50

>50

V. LOOSE

M. DENSE

V. DENSE

LOOSE

DENSE

< 2

2-4

4-8

8-15

15-30

>30



Boring No: GEO-7

		ہلار					Sheet:	1	Of:	1
	ightharpoonup I	nsig	ht	Project:	60 Olympia Avenu		Project Number:		2491-001	
				Location:	Woburn, Massachu		Chkd. By:	CAB		
rilling					ental Resources	Boring Location				
orema			Alan Su	ındquist		Ground Surfac	e Elevation:		Datum:	
	ght Eng.			Jared Sheeha		Date Started:		Date Complete	d: 06/12/03	
	DRILLING	METHOD			SAMPLER			ATER READINGS		
ehicle:		GeoP	robe	Type:	Macro Core	DATE	DEPTH	REFERENCE	STABILIZA	ATION
fodel:		Tru	ıck	Hammer(lb):		06/12/2003	~3'			
/lethod:				Fall (in):						
EPTH		SA	AMPLE						FIELD	NO.
(ft)	NO.	PEN/REC (in)	DEPTH (ft)	FEET		SAMPLE DE	SCRIPTION		SCREENING (ppm)	
0			0-4		Brown fine SAND,	some fine gravel.			0.0	1
					-				0.0	1
					1					
					-					
			4-6		Brown fine to medi	um SAND, some	fine gravel.		0.0	1
5					1					
			6-8	<u> </u>	72" - 84" - Black fi	ne to coarse SAN	D, some fine grave	 el.	0.0	1
					 84" - 96" - Tan fine	e SAND and SILT	_		-	
	_									
1			8-10		Brown fine to coars	se SAND and fine	GRAVEL.		0.0	1
•					-					
10			10-12		Tan SILT.		=		0.0	1
					-					
			12-14		Tan SILT.				0.0	1
					1					
					-				0.0	1
15					4 -{					
					End of Boring @ 16)'				
					GEO-7 installed @	16'				
			<u></u>		1" diameter PVC ris		PVC 10'.			
					Concrete .5', sand	16'.				
					-					

GRA	NULAR SOILS	COHE	SIVE SOILS
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
_10-30	M. DENSE	4-8	M. STIFF
)-5O	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

- 1. Soil samples screened in field for VOCs using jar headspace methods with a Thermo 580B PID equipped with an 11.6 eV lamp.
- 2. Samples analyzed for Total Organic Carbon and Volatile Organics.
- 3. Samples analyzed for Potassium Permanganate Demand.



Boring No:

GEO-1

Sheet:

6

Project:

60 Olympia Ave

Location: Woburn, Massachusetts

Project Number:

22491-00

With Offices In: Londonderry, NH

Westford, MA

Chkd. By: L.S. Falk

Drilling Co.: American Drilling Ser								ar railroad tracks			
Foreman	:		Charley B			Ground Surface Elevation:			N/A	Datum:	N/A
GeoInsig	ht En	g./Geol:	Jonathan (C. Brackett		Date Starte	ed:		Date Completed: 08/31/1999		
DR	ILLI	NG METI	HOD		SAMPLER			GROUND	WATER READ	INGS	
Vehicle:		Bomba	rdier	Туре:	Split Spoon (2)	" diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:	140 lbs		09/08/1999	4.29'	Top of PVC	N/A	
Method:		5"-4" C	asing	Fall:	30"						
DEPTH			MPLE						STRATUM	FIELD	NOTE
(ft)	NO.	PEN/REC	DEPTH	BLOWS/6"	SA	MPLE DI	ESCRIPTION OF THE PROPERTY OF	ON	DESCRIPTION	SCREENING	ľ
[(in)	(ft)					. 		(ppm)	
0	S-1	24/12	0-2	12	Medium dense, gr	-				6.6	
				9	some Gravel, little		Organic ma	terial at	SAND		
				10	0" to 2". Wet at ti	p.					
			_	20							
1	S-2	24/8	2-4	18	Medium dense, Gi	ray/tan med	lium to coars	e SAND,		2.4	
1				17	some Gravel, little	fine Sand.	l" black sta	ined			
				13	soil at 2" from tip.	Wet.					
				12]						
	S-3	24/10	4-6	11	Medium dense, gr					1,729	
				8	black/dark gray m			Sand (1");			
5				9	tan/brown SILT, I	ittle fine Sa	nd (8").				
				9					SILT		
	S-4	24/11	6-8	11	Very stiff, tan/bro					510	
				9	1/4" gray SILT wi	th little Cla	y seam at 4.5	5"			
1				9	from tip.						
I				11]						
Į	S-5	24/10	8-10	8	Very stiff, tan/bro	wn SILT, 1	trace fine Sar	nd (4.5");		328	
				9	olive/gray SILT,						
				8	1/8" gray Clayey	SILT seam	at 5.5" from	tip.			
				8]		
10	S-6	24/12	10-12	9	Stiff, light brown/	tan SILT, li	ittle to trace (Clay,		296	
				9	trace fine to medi		/8" gray clay	ey SILT			
				5	seam at 8.5" from	tip.			1		
				5	}				1		
	S-7	24/10.5	12-14	10	Very stiff, light br			race		90	
				10	little to trace Clay		y SILT,		[
ł				8	trace fine Sand (3'	").			-		
				10					1		
	S-8	24/13	14-16	5	Stiff, gray SILT,			lay seams	1	17.2	
				5	at 11", 8", 3.5", ar	ıd 1" from t	tip.				
15				5]				}		
				5							
1	S-9	24/17	16-18	5	Medium stiff gray	silty CLA	Y (1.5"); clay	/ey Silt (4");		2	
				3	silty CLAY (5");			CLAY (0.5");	SILTY CLAY		
				5	clayey SILT (1.5"); silty CLA	AY (2.5").		and		
				4	j				CLAYEY SILT		
									1		
		L			<u></u>						

NOTES:

GRANULAR SOILS COHESIVE SOILS BLOWS/ft. DENSITY BLOWS/ft. CONSISTENCY 0-4 V. LOOSE <2 V. SOFT 4-10 LOOSE 2-4 SOFT 10-30 M. DENSE 4-8 M. STIFF 30-50 DENSE 8-15 STIFF >50 V. DENSE 15-30 V. STIFF >30 HARD

- 1. Boring/well GEO-1 was completed using drive and wash drilling techniques.
- 2. Five-inch diameter steel casing was driven to 16.5' BGS and washed out.
- 3. Four-inch diameter steel casing was telescoped through the five-inch casing to a depth of 100' BGS.
- 4. Field screening performed using a ThermEnvironmental 580B calibrated to a an isobutylene standard. BGS = below ground surface.

					SOIL BORING LOG			Boring No:		GEO-1	
								Sheet:	2	Of:	6
		🔀 Ins	ight		Project:	60 Olympi	a Ave	1			
3774	06			NITT	, , , , , , , , , , , , , , , , , , , ,			Project Number:		22491-0	ю
WILL	OIII	ces In: Lo	naonaer ford, M <i>A</i>		Location: Wo	burn, Mass	sacnusetts	Chkd. By:	L. S. Falk		
Drilling	Co.:			Drilling Ser	vices. Inc.	Boring Lo	cation:		ear railroad tracks	 	
Foreman			Charley E				urface Elevat		N/A	Datum:	N/A
		ig./Geol:		C. Brackett		Date Start	ed:	08/24/1999	Date Completed:		
DF	ILL	ING METI	IOD		SAMPLER			GROUND	WATER REAL	DINGS	
Vehicle:		Bomba		Туре:	Split Spoon (2		DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:	140 lbs	 	09/08/1999	4.29'	Top of PVC	N/A	
Method: DEPTH		5"-4" C	asing AMPLE	Fall:	30"		<u> </u>	l	CTDATIM	ETEL D	Nome
(ft)	NO.		DEPTH	BLOWS/6"	SA	MPLE D	ESCRIPTI	ON	STRATUM DESCRIPTION	FIELD SCREENING	NOTE
(11)	1,40.	(in)	(ft)	DEC 116/0		MI DE D.	LbCidi II	.011	DESCRIPTION	(ppm)	
20	S-1	24/17	20-22	7	Stiff, gray clayey SIL7	(2"); silty C	LAY (1");			1.1	
				5	clayey SILT (1.5); oliv			ıy (1.5");	SILTY CLAY		
1				6	olive/gray silty CLAY	(1"); olive/gr	ay -orange/gray		and		
				8	clayey SILT (8"); brov	vn/orange silty	y Clay (0.5"); SI	ILT (1.5").	CLAYEY SILT		
1	<u> </u>				1						
	├	<u></u>			-						
		 			 						
ł	-	<u> </u>		 	1						
	\vdash			 	1						
25	S-1	24/12	25-27	8	Stiff, tan/light bro	wn SILT, s	ome fine Sar	nd.	SILT	0	
1				5	1	,					
				. 7]						
i				9]						
ł	<u> </u>				4				1		
1	<u> </u>		_	<u> </u>	4						<u> </u>
1	-	 		<u> </u>	-						
	-			-	†						<u> </u>
	-				1						
30	S-1	24/12	30-32	6	Stiff, tan/light bro	wn SILT, s	some fine Sar	nd, trace		0	
				6	medium Sand. Fi	ne sand siz	e mica flakes	present			ļ
				7	throughout.						
	<u></u>			8	1						
1	<u> </u>	ļ		 	4						ļ
	-			 	1						
S	-				1						
					1				}		
]						
35	S-1	24/14	35-37	11	Stiff, tan/light bro					0	
	<u> </u>			10	medium Sand. Fi	ne sand siz	e mica flakes	s present			
Į.	<u> </u>			11	throughout.						ļ
j	<u> </u>	 -		11							<u>i</u>
l	-	 		 	1					 	
				 	†						-
		l		 	1						
	GRAN	NULAR SOI	LS	СОН	ESIVE SOILS	NOTES:			<u> </u>	·	
BLOWS	/ft	DENS		BLOWS/ft.	CONSISTENCY				sing drive and wash		ues.
0-4	-	V. LO		<2	V. SOFT				riven to 16.5' BGS		
4-10		LOC		2-4	SOFT			_	elescoped through	the five-inch	
10-30		M. DE		4-8	M. STIFF		to a depth of		.	*******	
30-50 >50		DEN V. DE		8-15 15-30	STIFF				ermEnvironmental	580B calibrated	
		v. DE	NOE	>30	V. STIFF to a an isobutylene standard. HARD BGS = below ground surface.						

				SOIL BORING LOG			Boring No:	C	GEO-1		
[皇(」						Sheet:	3	Of:	6
		Ins	ight.		Project:	60 Olymp	oia Ave	Project Number:		22491-0	00
With	Offi	ces In: Lo	ondonder tford, MA		Location: Wo	burn, Mas	sachusetts	Chkd. By:	L. S. Falk		
Drilling	<u> </u>	vv esi		Drilling Ser	vices Inc	Boring L	ocation:		ear railroad tracks		
Foreman			Charley B		v1003, 1110.	4 -	Surface Elevat		N/A	Datum:	N/A
		g./Geol:		C. Brackett		Date Star			Date Completed:	-	
		ING MET		C. Brabaton	SAMPLER	Dave Daa:	T		WATER REAL		
Vehicle:	_	Bomba		Туре:	Split Spoon (2	" diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:	140 lbs		09/08/1999		Top of PVC	N/A	
Method:		5"-4" C		Fall:	30"		1				
DEPTH			AMPLE	<u></u>	1		'	<u> </u>	STRATUM	FIELD	NOTE
(ft)	NO.	PEN/REC	DEPTH	BLOWS/6"	SA	MPLE D	ESCRIPTI	ON	DESCRIPTION	1	
()		(in)	(ft)							(ppm)	ļ
40	S-1	24/17	40-42	10	Dense, olive/tan f	ine SAND	, some Silt, tr	ace		0	†
1				14	medium Sand. Fi				SAND		†
				18	1			-			
				14	1						
					1						
l]						
I											
ł]						
]						
45	S-1	24/16	45-47	4	Medium dense, ta	-			i	0	<u> </u>
ł	<u></u>		ļ	7	fine SAND, little					<u> </u>	
	<u> </u>		ļ	8	Fine sand size mica flakes throughout.					<u> </u>	ļ
	<u> </u>		 	12	4				1	ļ <u>.</u>	ļ
	<u> </u>		├──	ļ	4						ļ
	\vdash		} -	<u> </u>	-						-
ŀ	\vdash		├──		-						
					†						
			1		1						
50	S-1	24/7	50-52	3	Very loose, olive/	gray fine S	SAND, little S	Silt, trace		2.2	
				1	medium Sand. M	edium san	id size mica fl	akes			
ļ				3	throughout.						
1				3	_						<u> </u>
l			<u> </u>	ļ							ļ
	-		 								↓
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1	-	<u> </u>	 	<u> </u>	-						+
1	-	 	 	 	1				1	 	
55	S-1	24/14	55-57	5	Medium dense, o	live/brown	fine SAND.	some Silt (5.5"):		0	
				5	olive/brown SILT						
			 	7	Medium sand size	•			1		†
1	-			8	1		•				—
											1
1											
1											
					<u> </u>						
					ESIVE SOILS	NOTES		_			
	BLOWS/ft. DENSITY BLOWS/ft				. CONSISTENCY	_			sing drive and wasl		
0-4		V. LC		<2	V. SOFT				riven to 16.5' BGS		
4-10		LOC		2-4	SOFT	1		_	elescoped through	me nve-inch	
10-30			ENSE	4-8 R-15	M. STIFF STIFF						
>50	30-50 DENSE 8-15 >50 V. DENSE 15-30					7 0, 0					
1		۷. ال	117015	>30	V. STIFF to a an isobutylene standard. HARD BGS = below ground surface.						

					l l			Boring No:	G	EO-1		
j			サン						Sheet:	4	Of:	6
1	🖺	Ins	sight		Project:	60 0	Olympia	a Ave				
1		T T .		NTTT		337 - 1			Project Number:		22491-0	90
With	OIII	ces In: Lo	naonaer ford, M <i>A</i>		Location:	woburr	n, Mass	achusetts	Chkd. By:	L. S. Falk		
Drilling	<u> </u>	*******		Drilling Serv	vices. Inc.	Box	ring Lo	cation:	Low lying area ne			
Foreman			Charley B					rface Elevat		N/A	Datum:	N/A
GeoInsig		g./Geol:		C. Brackett		Dat	te Starte	ed:	08/24/1999	Date Completed:	08/31/1999	
		NG METI			SAMPLEI	R			GROUND	WATER REAL	DINGS	
Vehicle:		Bomba	ırdier	Туре:	Split Spoo		am.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:		0 lbs		09/08/1999	4.29'	Top of PVC	N/A	
Method:		5"-4" C		Fall:	3	10"						
DEPTH			MPLE	Dr Owore	ļ	CARAD	TEN	econtort	ON	STRATUM	FIELD	NOTE
(ft)	NO.	PEN/REC		BLOWS/6"	į	SAMP	LE DI	ESCRIPTI	UN	DESCRIPTION	SCREENING	
60	S-1	(in) 24/18	(ft) 60-62	8	Medium dense	a olive/t	tan with	come omno	a ctaining		(ppm)	
60	3-1	24/10	00-02	9	fine SAND, li			-	c stanting	SAND and SILT	-	
l	\vdash			11	Medium sand				_			 -
			<u> </u>	17		,						
										1		†
ļ					1							
1			 		1					}		
١	<u> </u>	0.4/1.0	1 25 25	-		4 6		D. Park	G:14 (1.08)			
65	S-1	24/13	65-67	5		Medium dense, tan fine SAND, little to trace Silt (10");					4.1	ļ
l	-			6	tan SILT, some fine Sand (3").							
	\vdash			8	I Vietium to co	Medium to coarse sand size mica flakes throughout.						
	⊢			-	1					1		
1	\vdash]	 -	1							
												
]							
}]							
1	<u> </u>											
70	S-2	24/20	70-72	4	Medium dens	•		•			2.9	
ł				5	Medium to co	oarse san	id mica	flakes throug	ghout.			<u> </u>
				8 14	-[
1				14	-					ļ		
i	 			 	1							
	一			 	1					1		
1					1							
					1							
75	S-2	24/11	75-77	5	Medium dens						0	
	L_		ļ	8	and SILT sear		olive/b	rown fine SA	AND,			ļ
	<u> </u>	ļ <u>-</u>		9	little Silt (4").		د					<u> </u>
	<u> </u>	<u> </u>	ļ <u> </u>	14	Medium to co	oarse san	ia size r	nica ilakes t	nrougntout.			┼
	\vdash	 	 	 	-							
			ļ		†							
	 				†					•		
	FRAI	NULAR SOI	LS	СОН	ESIVE SOILS	NO	OTES:			1		1
BLOWS		DENS			CONSISTEN			/well GEO-	l was completed us	sing drive and wash	drilling techniq	ues.
0-4		V. LC		<2	V. SOFT					riven to 16.5' BGS		
4-10		LOC	DSE	2-4	SOFT	3.	Four-ir	nch diameter	steel casing was to	elescoped through	the five-inch	
10-30		M. DI	ENSE	4-8	M. STIFF	- 1	_	to a depth o				
30-50		DEN		8-15	STIFF				_	ermEnvironmental	580B calibrated	
>50		V. DE	ENSE 15-30 V. STIFF to a an isobutylene standar >30 HARD BGS = below ground surface									
I				>30	DAKL	- ΙΦ\	0 ∸ دی	PROPERTY.	I SULLACE.			

	GFC Insigh	t
ith	Offices In: London	de
	Wortford	RAT.

Boring No:

GEO-1

Sheet:

Project Number:

Of: 6

rry, NH

Location:

Project:

Woburn, Massachusetts

60 Olympia Ave

22491-00

Westford, MA								Chkd. By:	L. S. Falk		
Drilling	Co.:			Drilling Ser	vices, Inc.	Boring Lo	cation:	Low lying area no			
Foreman	ı:		Charley E	Brackett		Ground St	ırface Elevat	ion:	N/A	Datum:	N/A
Geolnsig	ght En	g./Geol:	Jonathan	C. Brackett		Date Start	ed:		Date Completed:		
DR	ILL	ING METI	HOD		SAMPLER			GROUND	WATER READINGS		
Vehicle:		Bomba	ardier	Туре:	Split Spoon (2	" diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile	B-47	Hammer:	140 lbs	3	09/08/1999	4.29'	Top of PVC	N/A	
Method:		5"-4" C	Casing	Fall:	30"						
DEPTH		S	AMPLE						STRATUM	FIELD	NOTE
(ft)	NO.	PEN/REC	DEPTH	BLOWS/6"	SA	MPLE D	ESCRIPTI	ON	DESCRIPTION	SCREENING	
		(in)	(ft)							(ppm)	<u> </u>
80	S-2	24/12	80-82	8	Medium dense, ol			I SILT (5");		0	
				10	orange/brown fine				SAND and SILT		
				12	olive/tan fine SAN						
i				16	Fine to medium sa	and size mid	ca flakes thro	oughout.	1		
l]						
					1						
					<u> </u>						
				<u> </u>	ļ						
				<u> </u>							
85	S-2	24/12	85-87	5	Stiff, olive/tan SII					0	
				6	Fine to medium sa	and size mi	ca flakes thro	oughout.	1		
				8					1		
				5]						
			ĺ		1						
					1						
	\Box										
]						
	\Box			1	1						
]						
90	S-2	24/11	90-92	4	Medium dense, ol	live/tan fine	SAND, som	ne Silt.		0	
				6	Less mica flakes o	observed.			ļ.		
1	\Box			8							
				12					j		
			1								
			1			•					
ŀ			,							i	
1									1		
]]						
95	S-2	24/15	95-97	4	Medium dense ol	ive/brown f	ine SAND, I	ittle Silt (10");		0	
				8	olive/gray CLAY	, some Silt	(1");		SAND		
			1	12	olive/gray fine SA	AND, some	Silt (4").				1
			 	14	Fine to medium s			oughout.			
]	14 Fine to med										
					1						

GRANI	JLAR SOILS	COHE	SIVE SOILS
BLOWS/ft.	DENSITY	BLOWS/ft.	CONSISTENCY
0-4	V. LOOSE	<2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	V. DENSE	15-30	V. STIFF
		>30	HARD

- 1. Boring/well GEO-1 was completed using drive and wash drilling techniques.
- 2. Five-inch diameter steel casing was driven to 16.5' BGS and washed out.
- 3. Four-inch diameter steel casing was telescoped through the five-inch casing to a depth of 100' BGS.
- 4. Field screening performed using a ThermEnvironmental 580B calibrated to a an isobutylene standard. BGS = below ground surface.

	=	<u> </u>			SOIL BO	DINC	TOC	Boring No: GEO-1			
			\bigcirc		SOIL BU	KING	LOG	Boring No: Sheet:	6	Of:	6
		Ins	ight		Project:	60 Olympia	a Ave	·			
With	Offi	es In: Lo	ndonder	ry, NH	Location: Wo	burn, Mass	achusetts	Project Number:		22491-0	0
		West	ford, MA			T	1 - 4 * - 111	<u> </u>	L. S. Falk		
Drilling (Drilling Serv	rices, Inc.	Boring Lo		Low lying area no		D-+	- NT/A
Foreman			Charley B				ırface Elevat		N/A	Datum:	N/A
GeoInsig				C. Brackett	CAMPLED	Date Starte	ea:		Date Completed: WATER READ	08/31/1999	
	ILLI	NG METI		T	SAMPLER	1 4: \	DATE	·	REFERENCE		TION
Vehicle:		Bomba		Туре:	Split Spoon (2'			DEPTH 4.29'		STABILIZA	IION
Model:		Mobile		Hammer: Fall:	140 lbs		09/08/1999	4.29	Top of PVC	N/A	
Method: DEPTH		5"-4" C	MPLE	raii:	30			<u> </u>	STRATUM	FIELD	NOTE
				BLOWS/6"	SA.	MDIENI	ESCRIPTI	ON	DESCRIPTION	SCREENING	NOIE
(ft)	NO.	(in)	(ft)	DLOW3/0	SA.	WILLE DI	LICKII II	ON	DESCRIPTION	(ppm)	
100	S-2	24/10	100-102	73	Very dense, olive/	brown fine	to coarse SA	AND and		0	
				112	GRAVEL, little S				TILL		
				37			_				
		•••		23							
					Bor	ing Termina	ated at 102' I	BGS.			
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		ULAR SOI	LS		SIVE SOILS	NOTES:					
BLOWS	/ft.	DENS			CONSISTENCY				sing drive and wash		ues.
0-4		V. LO		<2	V. SOFT				riven to 16.5' BGS		
4-10		LOC		2-4	SOFT			_	elescoped through t	ne five-inch	
10-30		M. DE		4-8	M. STIFF STIFF		to a depth of		ermEnvironmental	500D anlih 1	
>50 >50	30-50 DENSE 8-15 >50 V. DENSE 15-30				V. STIFF		isobutylene		emmental	DODE CAHOTRICO	
1 -30		v. DE	101	>30	HARD		elow ground				

		7	WELL	COMPLETION LOG	Well Id GEO-1
	Ins	ioht	During at	60 Olympia Ava	Sheet: 1 Of: 1 Project Number: 22491-00
		O INC.	Project: Location:	60 Olympia Ave. Woburn, Massachusetts	Chkd. By: L. S. Falk
Drilling Co.	: Americ	an Drilling Services	2004110111	Well Location: Low lying	
Foreman:				Purpose of Well: Ground	Water Monitoring
Geolnsight	Rep: J.	C. Brackett		Date Started: 8/30/99	Date Completed: 8/31/99
DEPTH.		CONSTRUCTION DET	TAIL		ELEVATIONS
(ft)				Protective Casing: N/A	
		Steel Standpipe w	/ Lock	Inner Casing: N/A	Surveyor: N/A
0				Ground Surface: N/A	
					ATERIAL DETAILS
		Concrete - 0' to 2'	•	Lock Type: Master	Lock Key No: 3753
				Protective Casing: Yes	
20					
				Ricer a	nd Screen
ļ				Material: 2-inch Dia. Sch	
 				Coupling Type: Threaded	
40				Riser Length: 91.5 feet	
		Grout - 2' to 84' E	BGS	Screen Length: 10 feet	
				Screen Slot Size: 0.010	
		PVC Riser - +2.5	' to 89' BGS		
				Grout	
60				Amount: Approximately	80 gallons
				1	nite Seal
				Amount: 100 lbs (Bentor	nite Chips)
80				Filter P	Back
- 00		Bentonite - 84' to	BE' BGS	Amount: 250 lbs (No. 2	
·		Filter Sand - 86' to		Amount. 250 lbs (No. 2	miter saria;
ļ		Tittel Sand 50 to	0 100 200	Other	
		PVC Screen - 90'	to 100' BGS		
100					
		Bottom of Well @	100' BGS		
]			WELL DEV	ELOPMENT DETAILS
]			}	ft (below PVC)
)	Oft (BGS)
120				Date Developed: 9/8/99	
	<u> </u>			Method of Development:	Submersible Pump
	1				
	1				
	1				
Notes:	L				
140163.					

Γ					SOIL BORING LOG			Boring No:	G	EO-2		
		置り	ا ب باتِ		1				Sheet:	1	Of:	6
		ins	ight	1	Project:		60 Olympia	a Ave	1			
¥¥7843b		ces In: Lo		NTU	T -antion:	Wo	burn, Mass	ahmeette	Project Number:		22491-0	<u>'0</u>
VY ILLI	Om		onaonaer tford, M <i>A</i>		Location:		Duili, ividos	achuseus	Chkd. By:	L. S. Falk		ļ
Drilling (Co.:			Drilling Serv	vices, Inc.		Boring Lo	cation:	Low lying area ne			
Foreman			Charley B		· · · · · · · · · · · · · · · · · · ·		-	urface Elevat	tion:	N/A	Datum:	N/A
GeoInsig		ıg./G c ol:	Jonathan (C. Brackett			Date Starte	ed:		Date Completed:	09/07/1999	
		ING METI			SAMPL					WATER READ		
Vehicle:		Bomba		Туре:	Split Sp			DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile 5"-4" C		Hammer: Fall:		140 lbs 30"		09/08/1999	3.92'	Top of PVC	N/A	
Method: DEPTH	$\overline{}$		AMPLE	Faii.				1	<u> </u>	STRATUM	FIELD	NOTE
(ft)	NO.			BLOWS/6"	1	SA	MPLE DI	ESCRIPTI	ION	DESCRIPTION	SCREENING	1
()		(in)	(ft)			_					(ppm)	
0	S-1	24/12	0-2	2	Loose, brov	wn fine	to medium	n SAND, littl	le Coarse		0	
				3	-			trace Organi		SAND		
				4				ittle fine Sand	d (10").		l	
	إيا	24/16	 	4	1" gray stai				43775	ļ ,	<u> </u>	 _
	S-2	24/16	2-4	5	Loose, oran			n medium SA	AND,	1	18	
i			 	5	little line of	and. w	/CLALZ DO	15.		'		
	\vdash	 	 	6	1					·		-
l	S-3	24/0	4-6	8	No Recover	rv.						
l			ļ <u>-</u> -	7	1	-,.				}		†
5				10								
				9]					1		
	S-4	24/13	6-8	7					SAND, orange	SILT and SAND	371	
		<u> </u>	ļ	8				ip (10"); gray		1		<u> </u>
			↓	8				-	AY seam at 1"		ļ	ļ
	S-5	24/14	8-10	7 4	1/4" silty C			trom tip. me fine Sand	a.	}	146	
1	2-2	24/14	8-10	3				me nne Sand 3" and 9" fro:		1	140	
ŀ			 	2	1/7 311.7	-	.C11000 at 1-	MH4 / 11-	m up.			-
	-			3	1							
10	S-6	24/8	10-12	5	Medium sti	iff, gray	y SILT and	fine SAND.	•	1	161	
i				3]				•	1		
				3]							<u> </u>
		24/10	 	2			5 C	~ • • • • • • • •		1		<u> </u>
į	S-7	24/10	12-14	5				Sand, trace C	lay.	1	1.6	
1	-	 		5	1/4" Clay s	.cam at	4" from tip).				
	\vdash	 	 	5	-					1		
{	S-8	24/11	14-16	6	Stiff, gray	SILT,	little fine S	and, trace Cl	lay.		2.2	
l				6					nd 1" from tip.			<u></u>
15				5]							
i	ليا		<u> </u>	7	<u> </u>			== == 44 A		ļ		
	S-9	24/18	16-18	3				CLAY (4.5")		OH TWO LAW	2.2	ļ <u>-</u>
		 	 	5				AY (1"); clay T (2"); silty (yey SILT (2");	SILTY CLAY and	<u></u>	
		 	+	5	Silly CLA	(2),	Hayey	1 (2), Sury	CLAI (3).	CLAYEY SILT		
	\vdash		 	+	1					022.		
[†		1							—
(GRANULAR SOILS COI				ESIVE SOII	LS	NOTES:				<u> </u>	
BLOWS	1				CONSIST					sing drive and wash		ues.
0-4	0-4 V. LOOSE <2					FT				iriven to 18' BGS an		
4-10		LOC		2-4		FT				telescoped through t	he five-inch	
10-30		M. DE		4-8	M. ST			to a depth of		· · · · · · · · · · · · · · · · · · ·	500D - 10 1	
30-50 >50		DEN V DE		8-15	STIFF 4. Field screening perfor V. STIFF to a an isobutylene sta					ermenvironmental	580B canorated	
]		٠, ٢٠	ENSE 15-30 V. STIFF to a an isobutyle >30 HARD BGS = below groups									

						SOIL BORING LOG				Boring No: G		
								200	Sheet:	2	EO-2	-
		E Ins	ight		Project:		60 Olympi	a Ave			Of:	6
With	Offi	ces In: Lo	ondonder		Location:	Wo	burn, Mass	achusetts	Project Number:		22491-0	0
ļ			ford, MA						Chkd. By:	L. S. Falk		
Drilling	Co.:		American	Drilling Ser	vices, Inc.		Boring Lo	cation:	Low lying area no	ar railroad tracks		_
Foreman			Charley B	rackett			Ground St	ırface Elevat	ion:	N/A	Datum:	N/A
GeoInsig	ht En	ig./Geol:		C. Brackett			Date Start	ed:	08/31/1999	Date Completed:	09/07/1999	
		ING METI		1	SAMPL	ER	·]		WATER REAL		
Vehicle:		Bomba		Туре:			' diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:		140 lbs		09/08/1999	3.92'	Top of PVC	N/A	
Method:		5"-4" C		Fall:		30"						
DEPTH			AMPLE	1					···	STRATUM	FIELD	NOTE
(ft)	NO.			BLOWS/6"	1	SA	MPLE DI	ESCRIPTI	ON	DESCRIPTION	SCREENING	4
(-9		(in)	(ft)		ŀ						(ppm)	
20	S-1	24/17	20-22	5	Stiff gray S	II.T so	me fine Sa	nd, trace Cla	v (5")·		0.4	
1 2	۴÷			6				LT, little to		SILTY CLAY		
	-			5				e Silt (0.5");		and	···································	
1	-		 	7	little fine S	-			··· ,	CLAYEY SILT		
•				 '	inde ine s	anu, ue	ice Ciay (/	,		CLATETOIL		
l	\vdash	 	 	 	1					ļ		
i	-	 		 	1						ļ	
1	 	ļ — —		 						 	 	ļ
1	 	 		 						CAND 4-3 OF T		<u> </u>
	<u> </u>				-					SAND and SILT	ļ_ -	<u> </u>
l		04/11	25.05		Very stiff, tan fine SAND and SILT.							
25	S-1	24/11	25-27	9	Very stiff, tan fine SAND and SILT.						0.6	
1	<u> </u>	ļ		9								ļ
ł				8								ļ
1				7	4							
1	<u> </u>	<u> </u>	<u> </u>	ļ	1					}		
Į.	<u> </u>	<u> </u>									<u> </u>	
1					1							
ł				<u> </u>]							
1	L											
1												
30	S-1	24/10	30-32	10	Stiff, olive			d SILT.		ļ	0.6	
ł	Ĺ		, ,	8	Orange Sta	ining a	t 6" to 8".			1		
1	Ε			7	Fine sand s	ize mic	a flakes th	roughout.]		
	\Box			10								T
	\Box									1		
1												ļ
1												
										1		<u> </u>
i					1							
1]					1		
35	S-1	24/14	35-37	5	Medium de	ense, ol	ive/tan fine	to medium	SAND,		0.6	1
1				5	4			3"); SILT, lit	•	1		
1				6	4 ·	• •	•	nd content (4		1		
1	\vdash			8	fine SAND		-		**	1		i
1	\vdash			 	Fine sand s			roughout.	•			
1			<u> </u>		1							
1			 	 	1							
1		 	 		1						<u> </u>	
-	TRAN	NULAR SOI	LS	СОНЕ	ESIVE SOI	LS	NOTES:			I	1	l
GRANULAR SOILS COHE: BLOWS/ft. DENSITY BLOWS/ft.						/well GEO-2	was completed up	sing drive and wash	drilling technics	160		
0-4		V. LO		<2	V. SO		-			riven to 18' BGS an		
4-10		LOC		2-4		FT				elescoped through t		
10-30		M. DE		4-8	M. ST		1	to a depth of	-	riescopen mitougn t	ne mve-men	
1				1						ermEnvironmental	tthe GOO3	
I I						_	cimenvironmental	Deliated and				
1 -30	0 V. DENSE 15-30 V. STIFF to a an isobutylene s >30 HARD BGS = below ground											

			7/		SOIL BORING LOG			Boring No:	G	EO-2	
	B							Sheet:	3	Of:	6
i i		ដ Ins	ight		Project:	60 Olympia	a Ave				
1 XX 224 L		ces In: Lo	ndondon	. NET	Location:	Woburn, Mass		Project Number:		22491-0	0
With	Om		ford, MA		Location:	wodum, wass	achuseus	Chkd. By:	L. S. Falk		
Drilling	Co.:	***		Drilling Ser	vices. Inc.	Boring Lo	cation:	Low lying area ne		·	
Foreman			Charley B				ırface Elevat		N/A	Datum:	N/A
GeoInsig				C. Brackett		Date Starte	ed:	08/31/1999	Date Completed:	09/07/1999	
		ING METI			SAMPLER			GROUND	WATER REAL	DINGS	
Vehicle:		Bomba		Туре:	Split Spoon		DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:	140		09/08/1999	3.92'	Top of PVC	N/A	
Method: DEPTH		5"-4" C	asing MPLE	Fall:	30)"		l	STRATUM		Nome
(ft)	NO.			BLOWS/6"	,	SAMPLE DI	ESCRIPTION OF THE PERSON OF TH	ON	DESCRIPTION	FIELD SCREENING	NOTE
(11)	110.	(in)	(ft)	BEO W B/O	•	JAMIL DE DI	ESCICIT IT	O.N	DESCRIPTION	(ppm)	
40	S-1	24/10	40-42	2	Loose, olive/ta	n fine SAND a	nd SILT, litt	le to		0.9	
				2	trace medium S				SAND and SILT		
	П			3	Fine sand size	mica flakes thr	oughout.				
1				4	ļ						
]						
				ļ						ļ	
	<u> </u>			 							
	-				,						
45	S-1	24/13	45-47	2	Loose, olive/ta	n fine SAND	little to some	Silt.		0	
1.5	۳			3	Fine to mediun	•				├ 	
1				4	1			-6			
1				6							
]						
	<u> </u>				1						
	<u> </u>				1						
1	⊢			<u> </u>	1						ļ
50	S-1	24/12	50-52	2	Medium stiff, o	nlive/tan with	range staini	nø		0.4	
]	Ë			4	SILT and fine		J. 41.60 J. 41111	**6	SILT and SAND		
				4	olive/gray fine		LT (10").				
				5	Fine to mediun			oughout.			
1	_										
1	<u> </u>			 						<u> </u>	
1	-										
<u> </u>	\vdash	-		 						<u> </u>	<u> </u>
55	S-1	24/10	55-57	2	Medium stiff, o	olive/grav fine	SILT and SA	AND.		1.3	
"	Ħ	/	-	2	Medium sand s						
				3]						
				7							
1	<u> </u>										
	<u> </u>			ļ					1	<u> </u>	
1	<u> </u>								j		ļ
 	PAN	ULAR SOI	l S	CORE	SIVE SOILS	NOTES:			L	<u></u>	L
BLOWS		DENS		1	CONSISTEN		/well GFC⊾?	was completed us	ing drive and wash	drilling technics	100
0-4	,	V. LO		<2	V. SOFT				riven to 18' BGS an		103.
4-10		LOO		2-4	SOFT			_	lescoped through t		
10-30		M. DE		4-8	M. STIFF		to a depth of				
30-50		DEN	SE	8-15	STIFF				ermEnvironmental	580B calibrated	
>50		V. DE	NSE	15-30	V. STIFF		isobutylene				
1				>30	HARD	IBGS = p	elow ground	surface.			

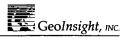
					SOIL BO	RING	LOG	Boring No:	(EO-2	
1					501250			Sheet:	4	Of:	6
i i					Project:	60 Olymp	ia Ave		· ·	. 01.	
		= Ins	ignt			oo Olymp	14 71 10	Project Number:		22491-0	10
With	Offi	ices In: Le	ondonder	rv. NH	Location: Wo	hum. Mas	sachusetts	l roject rumber.			
'''			ford. MA			Juli, 1,120	<u> </u>	Chkd. By:	L. S. Falk		
Drilling	Co.:			Drilling Ser	vices. Inc.	Boring L	ocation:		ar railroad tracks		
Foreman			Charley E		. 1000, 2110		urface Elevat		N/A	Datum:	N/A
GeoInsig		ng /Geol:		C. Brackett		Date Star			Date Completed:		
		ING MET			SAMPLER				WATER REAL		
Vehicle:		Bomb		Туре:	Split Spoon (2'	' diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile		Hammer:	140 lbs		09/08/1999		Top of PVC	N/A	111011
Method:		5"-4" (Fall:	30"		103/100/10333				
DEPTH			AMPLE						STRATUM	FIELD	NOTE
(ft)	NO.	PEN/REC	DEPTH	BLOWS/6"	SA	MPLE D	ESCRIPTI	ON	DESCRIPTION	SCREENING	1
(14)		(in)	(ft)							(ppm)	ŀ
60	S-1	24/11	60-62	3	Loose, tan fine SA	ND and S	ILT.			1.3	
"				5	Fine to medium sa			oughout.	SAND and SILT		
l				5				- -			
l				7	1						
1			 								
ł	 	 	 	t	l				ļ	ļ —	
1	 										+
			 	 							
i i	\vdash				1						
ł	ļ	 		 						ļ	
65	S-1	24/11	65-67	4	Loose, olive/tan fi	ne SAND	some to little	e Silt	1	1.2	
1 05	3-1	24111	03-07	5	Fine to medium sa						
	\vdash		 	5	1	0120 111	iou manos and	Juginous.		 	
				6	-				l .		
	<u> </u>	<u> </u>		 	1						+
1	-		 	 	1						
1					†						
İ	\vdash		 	 	1						†
ł	-	 	 		1						+
į				 	1						
70	S-2	24/17	70-72	5	Medium dense, ol	ive/tan fin	e with orange	staining SAND.		1	1
	-		· · · · · · ·	5	little to some Silt,						
l				6	olive/tan fine SAN			(-),			+
l			†·	8	Fine to medium sa			oughout.	SAND and SILT		 -
	一	 	i								+
1				 	1						
İ			·	 	1						1
l		 	 	†	1						
1					1						
		1	1	1	1						
75	S-2	24/13	75-77	5	Stiff, orange/tan fi	ne SAND	and SILT, w	ith 1/8" silty		1.7	
[6	CLAY seam at 1"			-			1
l				9	some Silt with 1/8	-		•			
Į.			T T	12	top (3.5"); intermi						1
1			1		seams (7").						
1					Fine sand size mid	a flakes tl	hroughout.		1		T
1]				i		
		I			<u></u>						T
	GRA	NULAR SO	ILS	COH	ESIVE SOILS	NOTES	:				
BLOWS		DEN		BLOWS/ft.	CONSISTENCY	1. Borin	g/well GEO-2	2 was completed us	sing drive and wash	drilling technia	ues.
0-4		V. LC		<2	V. SOFT		-	•	riven to 18' BGS as	· ·	
4-10		LO	OSE	2-4	SOFT			_	elescoped through		
10-30		M. Di	ENSE	4-8	M. STIFF		g to a depth o	_		•	
30-50		DE		8-15	STIFF				ermEnvironmental	580B calibrated	
>50			ENSE	15-30	V. STIFF		n isobutylene	_			
I				>30	HARD	BGS =	below ground	i surface.			

ſ			$\overline{}$		SOIL BO	RING	LOG	Boring No:	G	EO-2		
					n			Sheet:	5	Of:	6	
	<u> </u>	ins ins	ignt		Project:	60 Olympia	a Ave	Project Number:		22491-0	00	
With	Offi	ces In: Lo West	ndonder ford, MA		Location: Wo	burn, Mass	achusetts	Chkd. By:	L. S. Falk			
Drilling	Co.:			Drilling Serv	vices, Inc.	Boring Lo	cation:	Low lying area no	ar railroad tracks			
Foreman	:		Charley B	rackett		Ground St	rface Elevat		N/A	Datum:	N/A	
		ig./Geol:		C. Brackett		Date Starte	ed:	08/31/1999	Date Completed:	09/07/1999		
DF	ILL	ING METI	IOD		SAMPLER			GROUND	O WATER READINGS			
Vehicle:		Bomba	rdier	Туре:	Split Spoon (2'	" diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION	
Model:		Mobile	B-47	Hammer:	140 lbs		09/08/1999	3.92'	Top of PVC	N/A		
Method:		5"-4" C	asing	Fail:	30"							
DEPTH		SA	MPLE						STRATUM	FIELD	NOTE	
(ft)	NO.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	SA	MPLE DI	ESCRIPTI	ON	DESCRIPTION	SCREENING (ppm)	ľ	
80	S-2	24/12	80-82	4	Stiff, gray fine SIL	T and SAN	VD (4.5");		SILT and SAND	0.7	 	
				8	olive/tan fine SILT						 	
				11	Fine sand size mic							
l				12	1		-		Į		 	
l					1							
•	\vdash			<u> </u>	1							
					1							
					1				1		1	
					1							
]							
85	S-2	24/12	85-87	3	Medium dense, gr	ay fine SAl	ND, little to	some Silt.		0		
į .				5	Fine sand size mid	ca mica flak	es throughou	ut.	SAND			
İ				6								
l		<u> </u>		10]							
	<u></u>				_						<u> </u>	
	<u></u>				1							
1	<u> </u>				1							
					1						ļ	
					4							
90	S-2	24/6	90-92	9	Medium dense, ol	ive/may wi	th orange sta	ining fine SAND		0		
30	3-2	24/0	70-72	5	little Silt.	ive/gray wi	ui orange su	ming mic SAND,		<u> </u>	 	
				7	Medium sand size	mica flake	s throughout	t.			 	
				13							1	
l					1							
					1							
]							
l					1				1			
ı	<u></u>				1				1			
05	0.0	24/20	05.07							<u> </u>	<u> </u>	
95	S-2	24/20	95-97	5	Medium dense, of little medium to co		-	-		0.5	 	
ŀ	\vdash			12	Increasing silt con						 	
	-		<u> </u>	12	Medium sand size		•	•			 	
l					1	, milou mane	o anoughou	•			 	
				<u> </u>	1					 	 	
			· · · · ·		1						 	
					1							
,	GRAI	VULAR SOI	LS	СОН	ESIVE SOILS	NOTES:	···					
BLOWS	/ft.	DENS	SITY	BLOWS/ft.	CONSISTENCY	1. Boring	/well GEO-2	was completed us	ing drive and wash	drilling techniq	ues.	
0-4		V. LO	OSE	<2	V. SOFT			steel casing was d				
4-10		LOC	SE	2-4	SOFT			steel casing was to	elescoped through t	he five-inch		
10-30		M. DE	INSE	4-8	M. STIFF		to a depth o					
30-50		DEN		8-15	STIFF			formed using a Th	ermEnvironmental	580B calibrated		
>50		V. DE	NSE	15-30	V. STIFF		isobutylene					
i				>30	HARD	BGS = b	elow ground	surface.				

			$\overline{}$		SOT	I. RO	RING	LOG	Boring No:	GEO-2		
					501			200	-			
			الجهين		D:				Sheet:	6	Of:	6
)		🚉 Ins:	ight		Project:		60 Olympia	a Ave				
			O INC.						Project Number:		22491-0	0
With	Offi	ces In: Lo			Location:	Wo	burn, Mass	achusetts				
		West	ford, MA		<u> </u>				Chkd. By:	L. S. Falk		
Drilling (Co.:		American	Drilling Serv	vices, Inc.		Boring Lo	cation:	Low lying area ne	ar railroad tracks		
Foreman	:		Charley B	rackett			Ground Su	rface Elevati	ion:	N/A	Datum:	N/A
GeoInsig	ht En	g./Geol:	Jonathan (C. Brackett			Date Starte	ed:	08/31/1999	Date Completed:	09/07/1999	
		NG METH	IOD		SAMPI	ER			GROUND	WATER REAL	INGS	
Vehicle:		Bomba	rdier	Туре:	Split Sp	200n (2'	' diam.)	DATE	DEPTH	REFERENCE	STABILIZA	TION
Model:		Mobile	B-47	Hammer:		140 lbs		09/08/1999	3.92'	Top of PVC	N/A	
Method:		5"-4" C		Fall:		30"						
DEPTH			MPLE	1	<u> </u>				\	STRATUM	FIELD	NOTE
(ft)	NO.	PEN/REC		BLOWS/6"		SAT	MPLE DI	ESCRIPTI	ON	DESCRIPTION	SCREENING	NOIL
(11)	140.		(ft)	DEC W3/0		SA.	MII LE DI	SCRII II	ON	DESCRI HOR	1	[
	ج	(in)		L	171	-1:- /		3775	14 (911)		(ppm)	
100	S-2	24/12	100-102	15				ND, some Si		2	0.4	
1				30				little mediur		SAND		
I	\sqcup			25				Sand, trace fi				
				40	Medium sa	and size	mica flake	s throughout	•			
ſ					[[
l					L							
					Bit advanc	ing with	difficulty	beginning at	103' BGS.			
1	\vdash				1	-	•					
	_	-			1					TILL		
]					Bit refusal	at 105'	BGS.					
105	S-2	6/4	105-107	21	4			edium SAND	1/2"\•		0.2	
103	3-2	- 0/4	105-107	50/<1"	4 -	_			ttle Silt (2").		0.2	
ŀ				30/~1					ille Siii (2).			
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BLOWS	/IL	DENS		BLOWS/ft.			4 -		-	ing drive and wash		ies.
0-4		V. LO		<2	V. SC		1		-	riven to 18' BGS ar		
4-10		LOO		2-4)FT				elescoped through t	he five-inch	
10-30		M. DE	NSE	4-8	M. ST	TFF		to a depth of				
30-50		DEN	ISE	8-15	ST	IFF	4. Field s	creening per	formed using a Th	ermEnvironmental	580B calibrated	
>50		V. DE	NSE	15-30	V. ST	IFF	to a an	isobutylene	standard.			
1				>30	HA	RD		elow ground				

		VVELL	COMPLETION LOG	Well Id.:	GEO-2	
	Topological			Sheet:	1 Of:	1
	Insight	Project:	60 Olympia Ave.		nber: 22491-00	
		Location:	Woburn, Massachusetts			
	American Drilling Se	ervices	Well Location: Low lying			
	arley Brackett		Purpose of Well: Ground			
eolnsight Re	p: J. C. Brackett		Date Started: 9/6/99		leted: 9/6/99	_
EPTH	CONSTRUCT	ION DETAIL	1	E ELEVATIONS		
(ft)			Protective Casing: N/A			
0	Steel Stand	lpipe w/ Lock	Inner Casing: N/A Ground Surface: N/A	Surveyor:	N/A	
			WELL	MATERIAL DET	TAILS	
	Concrete -	0' to 2'	Lock Type: Master	r Lock K	ey No: 3753	
			Protective Casing: Yes			
			_			
20			1			
			1			
			Riser	and Screen		
			Material: 2-inch Dia, So		10	
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			Coupling Type: Threads			
40			Riser Length: 97.5 feet			
	Grout - 2'	to 90' BGS	Screen Length: 10 feet			
			Screen Slot Size: 0.010)		
	PVC Riser	- +2.5' to 95' B0	GS (
			Grou	t		
60			Amount: Approximately	y 80 gallons		
			Bento	onite Seal		
			Amount: 100 lbs (Bent			
				.ormeo		
80			Filter	Pack		
	Bentonite	- 90' to 92' BGS	Amount: 250 lbs (No.	2 filter sand)		
		f - 92' to 105' BG	1	_ ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
		. 02 (0 .00 20	Othe	r		
	PVC Scree	en - 95' to 105' B		•		
100	IHI					
	H Bottom of	Well @ 105' BGS	: \			
	LI DOLLOIN O	Won @ 100 Bac	l l	EVELOPMENT	DETAILS	
				92 ft (below		
				05 ft (BGS)	1 40)	
100						
120			Date Developed: 9/8/		t- D	
			Method of Developmen	it: Submersil	pie Pump	

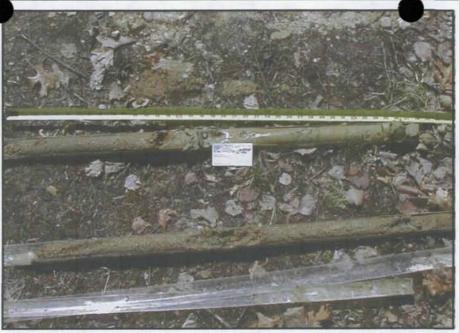
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APPENDIX C Photographs of Soil Borings



GEO-SB-98D- (Top to bottom: 0 - 4', 4' - 8', 8' - 12' and 12' - 16'). The transition from sand to silt can be seen in the 4' - 8' sleeve above the iron staining, at $\sim 6'$. The color change in the 12' - 16' sleeve shows the fine silt layer above the gray silt with trace of clay.



GEO-SB-103 (Top to bottom: 15' -20' and 10' -15'). The transition from sand to silt is apparent at \sim 18.5', and the silt with a trace of clay at 19'.



GEO-SB-100. The transition from sand to silt can be seen at ~6' below grade.



GEO-SB-100 (8' - 12') shows silt with a trace of clay from 11' to 12' below grade.



GEO-SB-101 (4' - 8') shows the transition of fine to medium sand to a fine sand with some silt at 6' below grade.



GEO-SB-101 (16' - 20') shows silt transitioning to a trace of clay from light brown to gray at 19' below grade.



GEO-SB-102 (10' - 15') shows the transition from a fine to coarse sand to a very fine silt at 11.5' below grade.

GEO-SB-102 (15' - 20') shows the transition from sand to silt to silt with a trace of clay.



PROJECT 2491-001 GFO Insight



APPENDIX D

Laboratory Reports: Sewer Line Investigation

Thorstensen Laboratory, Inc.

66 LITTLETON ROAD, WESTFORD, MA 01886

(978) 692-8395 FAX (978) 692-0023 1-800-649-TEST

Report Number: 72507

Client

Report Date: April 24, 2003

Sample Taken At:

Brett Beaulieu

GeoInsight

319 Littleton Road, Suite 100

Westford MA 01886

Fecal Coliform

60 Olympia St.

Woburn

Sample taken by: Client

Date Sampled: 4/22/03

Certificate of Analysis

SAMPLE ID	FECAL COLIFORM RESULTS	UNITS
OL-2	<100	per 100ml
MW-13	<100	per 100ml
MW-145	<100	per 100ml

Method of Analysis: 9222D

Massachusetts State Certified Testing Laboratory #MA048 Michael P. Carlson, for Thorstensen Laboratory Inc.



April 30, 2003

Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532

Telephone (508) 759-4441 FAX (508) 759-4475 www.groundwateranalytical.com

Mr. Kevin Trainer Geolnsight, Inc. 319 Littleton Rd. Suite 105 Westford, MA 01886

LABORATORY REPORT

Project:

60 Olympia/2491

Lab ID:

60331

Received:

04-23-03

Dear Kevin:

Enclosed are the analytical results for the above referenced project. The project was processed for Priority turnaround.

This letter authorizes the release of the analytical results, and should be considered a part of this report. This report contains a sample receipt report detailing the samples received, a project narrative indicating project changes and non-conformances, a quality control report, and a statement of our state certifications.

The analytical results contained in this report meet all applicable NELAC standards, except as may be specifically noted, or described in the project narrative. This report may only be used or reproduced in its entirety.

1 attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Should you have any questions concerning this report, please do not hesitate to contact me.

Sincerely,

Jonathan R. Sanford

President

JRS/pcl Enclosures



Sample Receipt Report

Project: 60 Olympia/2491 Client: Geolnsight, Inc.

Lab ID: 60331

Delivery: GWA Courier

Airbill: n/a Lab Receipt: 04-23-03 Temperature: 2.0'C
Chain of Custody: Present

Custody Seal(s): n/a

Lab ID	Field ID	200	Matrix	Sampled	Method		1 1 E E	Notes	: .	:
60331-1	MW-0145	· · <u> · · · · · · · · · · · · · · ·</u>	Aqueous	4/22/03 12:05	EPA 8260B T	CL Volatile On	ganics			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C269238	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
C269250	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
C269226	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
Lab ID	Field ID		Matrix	Sampled	Method		er er er er er er er er er er er er er e	Notes		
60331-2	MW-013	- 	Aqueous		EPA 8260B TO	CI Volatile Or	eanics	roces	···	
Con ID	Container					·	Ship			
C269274	40 mL VOA Vial	Vendor Industrial	QC Lot BX7101	Preserv	QC Lot R-3173F	<u>Prep</u> 03-14-03	03-24-03			
C269286	40 mL VOA Vial	Industrial	BX7101	HCI —	R-3173F	03-14-03	03-24-03			
C269262	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
. (203202	40 IIIL VOA VIAI	- MOUSUIAI	BA/ IOI			05-14-05	05-24-05			
Lab ID	Field ID		Matrix	Sampled	Method			Notes		
60331-3	OL-2		Aqueous	4/22/03 13:35	EPA 8260B T	CL Volatile Org	ganics			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C269269	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
C269280	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
C269281	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03			
Lab ID	Field ID		Matrix	Sampled	Method			Notes	- 1 - 1 1	- :
60331-4	MW-0145		Aqueous	: 	EPA 9056 Ch	lorida :	·			
003317	1414-0 (43		Adneons	_ - 4/22/03 12:03						
					,EPA 9214 Flu					
			. -		SM 4500-NO					
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
_C097930	500 mL Plastic	Proline	BX543	None	<u>n/a</u>		. n/a		· ·	
Lab ID	Field ID		Matrix	Sampled	Method			Notes	7 77	 -,-
60331-5	MW-013		Aqueous	. 4/22/03 12:55	EPA 9056 Ch	loride				
					-EPA 9214 Flu	oride				
					SM 4500-NO	3 F Nitrate				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship		·· - — ·	
C097927	500 mL Plastic	Proline	BX543	None	n/a	n/a	n/a			
								int an		 -
Lab ID	Field ID	N 1242 0.	Matrix	Sampled	Method			Notes		
60331-6	OL-2		Aqueous	4/22/03 13:35	EPA 9056 Ch					
					EPA 9214 Flu					
					SM 4500-NO	3 F Nitrate				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C260170	250 mL Plastic	Proline	BX5483	None	n/a	<u>n/a</u>	11-27-02			
C263026	250 mL Plastic	Proline	BX6729	None	n/a	<u>n/a</u>	02-06-03			
Lab ID	field ID		Matrix	Sampled	Method		T. 4 1	Notes	क् अ	-1 1
60331-7	MW-0145	·	Aqueous	<u> </u>	SM 4500-NH.	3 BG Ammonia		1.77		
Con 1D	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	· 		
C260451	250 mL Plastic	Proline	BX5482	H2SO4	R-3484E	10-04-02	10-23-02	·		
LabID	Field ID		Matrix	Sampled	Method		<u> </u>	Notes		<u> </u>
60331-8	MW-013		Aqueous	4/22/03 12:55	SM 4500-NH	3 BG Ammonia				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C260409	250 mL Plastic	Proline	BX5482	H25O4	R-3484E	10-04-02	10-23-02			



Sample Receipt Report (Continued)

Project: 60 Olympia/2491

Delivery: GWA Courier

Temperature: 2.0°C

Client: Geolnsight, Inc.

Airbill: n/a

Chain of Custody: Present

Lab ID: 60331

Lab Receipt: 04-23-03

Custody Seal(s): n/a

Lab ID	Field ID	1	Matrix	Sampled	Method			Not	es	
60331-9	OL-2		Aqueous	4/22/03 13:35	SM 4500-NH	3 BG Ammonia				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C260450	250 ml. Plastic	Proline	BX5482	H25O4	R-3484E	10-04-02	10-23-02			



EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID: MW-0145 Laboratory ID: 60331-01 Project: 60 Olympia/2491 OC Batch ID: VM4-2575-W Geolnsight, Inc. Sampled: Client: 04-22-03 Container: 40 mL VOA Vial Received: 04-23-03 HCI / Cool 04-27-03 Preservation: Analyzed:

Matrix: Aqueous Dilution Factor: 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
74-87-3	Chloromethane	BRL	ug/L	1
75-01-4	Vinyl Chloride	19	ug/L	1
74-83-9	Bromomethane	BRL	ug/L	1
75-00-3	Chloroethane	BRL	ug/L	1
75-35-4	1,1-Dichloroethene	BRL	ug/L	1
67-64-1	Acetone	BRL.	ug/L	20
75-15-0	Carbon Disulfide	BRL	ug/L	10
75-09-2	Methylene Chloride	BRL	ug/L	5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	1
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	1
75-34-3	1,1-Dichloroethane	BRL	ug/L	1
156-59-2	cis-1,2-Dichloroethene	61	ug/L	1
78-93-3	2-Butanone (MEK)	BRL	ug/L	10
67-66-3	Chloroform	BR⊥	ug/L	1
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	1
56-23-5	Carbon Tetrachloride	BRL	ug/L	1
71-43-2	Benzene	BRL	ug/L	1
107-06-2	1,2-Dichloroethane	BRL	ug/L	1
79-01-6	Trichloroethene	6	ug/L	1
78-87-5	1,2-Dichloropropane	BRL	ug/L	1
75-27-4	Bromodichloromethane	BRL	ug/L	1
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	1
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	10
108-88-3	Toluene	BRL	ug/L	· · · ·
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	1
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	1
127-18-4	Tetrachloroethene		ug/L	1
591-78-6	2-Hexanone	BRL	ug/L	10
124-48-1	Dibromochloromethane	BRL	ug/L	1
108-90-7	Chlorobenzene	BRL	ug/L	1
100-41-4	Ethylbenzene	BRL	ug/L	1
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	1
95-47-6	ortho- Xylene	BŔL	ug/L	1
100-42-5	Styrene	BRL	ug/L	1
75-25-2	Bromoform	BRL	ug/L	1
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	1
QC	Surrogate Compounds	Recovery	- Qe	C Limits
Dibromofluoromet		99 %		- 118 %
1,2-Dichloroethane		99 %		- 120 %
Toluene d ₈		98 %		- 110 %
4-Bromofluorobenz		108 %	86	- 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.

Indicates additional target analyte.



EPA Method 8260B TCL Volatile Organics by GC/MS

Laboratory ID: 60331-02 Field ID: MW-013 QC Batch ID: Project: VM4-2574-W 60 Olympia/2491 Sampled: Client: Geolnsight, Inc. 04-22-03 04-23-03 Container: 40 mL VOA Vial Received: Analyzed: 04-26-03 Preservation: HCI / Cool Dilution Factor: Matrix: Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Limit		
74-87-3	Chloromethane	BRL	n8/F	10		
75-01-4	Vinyl Chloride	BRL	ug/L	10		
74-83-9	Bromomethane	BRL	ug/L	10		
75-00-3	Chloroethane	BRL	ug/L	10		
75-35-4	1,1-Dichloroethene	BRL	ug/L	10		
67-64-1	Acetone	BRL	ug/L	200		
75-15-0	Carbon Disulfide	BRL	ug/L	100		
75-09-2	Methylene Chloride	BRL	ug/L	50		
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	10		
1634-04-4	Methyl tert-butyl Ether (MTBE) "	BRL	ug/L	10		
75-34-3	1,1-Dichloroethane	BRL	ug/L	10		
156-59-2	cis-1,2-Dichloroethene	780	ug/L	10		
78-93-3	2-Butanone (MEK)	BRL	ug/L	100		
67-66-3	Chloroform	BRL	n8/r	10		
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	10		
56-23-5	Carbon Tetrachloride	BRL	ug/L	10		
71-43-2	Benzene	BRL	ug/L	10		
107-06-2	1,2-Dichloroethane	BRL	ug/L	10		
79-01-6	Trichloroethene	280	ug/L	10		
78-87-5	1,2-Dichloropropane	BRL	ug/L	10		
75-27-4	Bromodichloromethane	BRL	ug/L	10		
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	10		
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	100		
108-88-3	Toluene	BRL	ug/L	10		
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	10		
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	10		
127-18-4	Tetrachloroethene	650	ug/L	10		
591-78-6	2-Hexanone	BRL	ug/L	100		
124-48-1	Dibromochloromethane	BRL	ug/L	10		
108-90-7	Chlorobenzene	BRL	ug/L	10		
100-41-4	Ethylbenzene	BRL	ug/L	10		
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	10		
95-47 - 6	ortho-Xylene	BRL	ug/L	10		
100-42-5	Styrene	BRL	ug/L	10		
75-25-2	Bromoform	BRL	ug/L	10		
79-34-5 1,1,2,2-Tetrachloroethane		BRL	ug/L	10		
	Surrogate Compounds	incore i	QC Limits			
Dibromofluorometi		97 %		5 - 118 %		
1,2-Dichloroethane	+d ₄	96 %) - 120 %		
Toluene d ₈		97 %	88 - 110 %			
4-Bromofluorobenz	rene	109 %	86	86 - 115 %		

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis

performed utilizing 25mL sample purge volume.

Report Notations: BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.

Indicates additional target analyte.



EPA Method 8260B TCL Volatile Organics by GC/MS

QL-2 Field ID: Laboratory ID: 60331-03 60 Olympia/2491 QC Batch ID: VM4-2574-W Project: Geolnsight, Inc. Sampled: 04-22-03 Client: 40 mL VOA Vial Received: 04-23-03 Container: Preservation: HCI / Cool Analyzed: 04-26-03 Matrix: Aqueous Dilution Factor:

CAS Number	Analyte	Concentration	Units Reporting Limit
74-87-3	Chloromethane	BRL	ug/L 1
75-01-4	Vinyl Chloride	BRL	ug/L 1
74-83-9	Bromomethane	BRL	ug/L 1
75-00-3	Chloroethane	BRL	ug/L 1
75-35-4	1,1-Dichloroethene	BRL	: ug/L 1
67-64-1	Acetone	BRL	ug/L 20
75-15-0	Carbon Disulfide	BRL	ug/L 10
75-09-2	Methylene Chloride	BRL	ug/L 5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L 1
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L 1
75-34-3	1,1-Dichloroethane	BRL	ug/L 1
156-59-2	cis-1,2-Dichloroethene	4	ug/L 1
78-93-3	2-Butanone (MEK)	BRL	ug/L 10
67-66-3	Chloroform	BRL	ug/L 1
71-55-6	1,1,1-Trichloroethane	BRL	ug/L 1
56-23-5	Carbon Tetrachloride	BRL	ug/L 1
71-43-2	Benzene	BRL	ug/L 1
107-06-2	1,2-Dichloroethane	BRL	ug/L 1
79-01-6	Trichloroethene	91	ug/L 1
78-87-5	1,2-Dichloropropane	BRL	ug/L 1
75-27-4	Bromodichloromethane	BRL	ug/L 1
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/L 1
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L 10
108-88-3	Toluene	BRL	ug/L 1
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L 1
79-00-5	1,1,2-Trichloroethane	BRL	ug/L 1
127-18-4	Tetrachloroethene	3	ug/L : 1
591-78-6	2-Hexanone	BRL	ug/L 10
124-48-1	Dibromochloromethane	BRL	ug/L i 1
108-90-7	Chlorobenzene	BRL	ug/L 1
100-41-4	Ethylbenzene	BRL	ug/L 1
108-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L 1
95-47-6	ortho- Xylene	BRL	ug/L 1
100-42-5	Styrene	BRL	ug/L 1
75-25-2	Bromoform	BRL	ug/L 1
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L 1
QC!	Surrogate Compounds	Recovery	QC Limits
Dibromofluoromet		99 %	86 - 118 %
1,2-Dichloroethane		100 %	80 - 120 %
Toluene-d ₈		98 %	88 - 110 %
4 Promofly orobons		107 %	96 115 %

107 % 4-Bromofluorobenzene

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.

Indicates additional target analyte.



Inorganic Chemistry

Field ID: MW-014S 60 Olympia/2491 Project: Client:

Geolnsight, Inc.

Matrix: Aqueous Received:

04-23-03

Lab ID:	60331-04	Sampled:	04-22-03	12:05	;	Containe	er: 50	00 mL Plastic		Preservation:	Cool
	Analyte		Resu	H	Units	Reportin Limit	8	Analyzed		QC Batch	Method
Chloride	2		93		, mg/L	6	-	04-24-03	1	CL-0330-W	EPA 9056
Fluoride	·		!	BRL	mg/L	0.04	:	04-25-03	·	FL-0331-W	EPA 9214
Nitrate	as Nitrogen)		0.26		mg/L	0.02	:	04-24-03 09:30	,	NI-1751-W	SM 4500-NO3 F

Lab ID: 60331-07	Sampled: 04	22-03 12:	05 (Container:	250 mL Plastic	Preservation:	H2504/Cool
Analyte		Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Ammonia (as Nitrogen)		0.4	mg/L	0.2	04-28-03	AM-1146-W	5M 4500-NH3 BG

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and **Method References:**

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), and Standard Methods for the Examination of Water and Wastewater,

APHA, Eighteenth Edition (1992).

Report Notations: BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest

value that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.



Inorganic Chemistry

Field ID:

Project:

Client:

MW-013

60 Olympia/2491 Geolnsight, Inc.

Matrix:

Aqueous

Received:

04-23-03

Lab ID: 60331-05	Sampled: 0	ed: 04-22-03 12:55			500 mL Plastic	Preservation: Cool	
Analyte		Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Chloride		110	mg/L	6	04-24-03	CL-0330-W	EPA 9056
Fluoride		BRL	mg/L	0.04	04-25-03	FL-0331-W	EPA 9214
Nitrate (as Nitrogen)		0.03	mg/L	0.02	04-24-03 09:28	NI-1751-W	SM 4500-NO3 F

Lab ID: 60331-08	Sampled: 04-22-	-03 12:55	Container: 250 mL Plastic		Preservation: H2SO4/Cool	
Analyte	R	esult Units	Reporting Limit	Analyzed	QC Batch	Method
Ammonia (as Nitrogen)		0.3 mg/L	0.2	04-28-03	AM-1146-W	SM 4500-NH3 BG

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), and Standard Methods for the Examination of Water and Wastewater,

APHA, Eighteenth Edition (1992).

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.



Inorganic Chemistry

Field ID: OL-2

Project: Client:

60 Olympia/2491 Geolnsight, Inc.

Matrix:

Aqueous

Received:

04-23-03

Lab ID: 60331-06	Sampled: 04	4-22-03 13:35	5	Container:	250 mL Plastic	Preservation	: Coal
Analyte		Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Chloride		270	mg/L	6	04-24-03	CL-0330-W	EPA 9056
Fluoride		BRL	mg/L	0.04	04-25-03	FL-0331-W	EPA 9214
Nitrate (as Nitrogen)	BRL	mg/L	0.02	04-24-03 09:32	NI-1751-W	SM 4500-NO3 F

Lab ID:	60331-09	Sampled:	04-22-03 13:	35	Container:	250 mL Plastic	Preservation:	H2SO4/Cool
- 3	Analyte		Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Ammoni	a (as Nitrogen)		1.3	mg/L	0.2	04-28-03	AM-1146-W	SM 4500-NH3 BG

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), and Standard Methods for the Examination of Water and Wastewater, APHA, Eighteenth Edition (1992).

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.



Project Narrative

Project: Client:	60 Olympia/2491 Geolnsight, Inc.	Lab ID: Received:	60331 04-23-03 18:30
	A. Documentati	ion and Client Communication	
The follow	ring documentation discrepancies, and client of	changes or amendments were noted for this	project:
1.	No discrepancies, changes, or amendments	s were noted.	
	B. Meth	nod Non-Conformances	

The following method non-conformances were noted for this project:

1. No method non-conformances were noted.

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Quality Assurance/Quality Control

A. Program Overview

Groundwater Analytical conducts an active Quality Assurance program to ensure the production of high quality, valid data. This program closely follows the guidance provided by *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, US EPA QAMS-005/80 (1980), and Test Methods for Evaluating Solid Waste, US EPA, SW-846, Update III (1996).

Quality Control protocols include written Standard Operating Procedures (SOPs) developed for each analytical method. SOPs are derived from US EPA methodologies and other established references. Standards are prepared from commercially obtained reference materials of certified purity, and documented for traceability.

Quality Assessment protocols for most organic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. All samples, standards, blanks, laboratory control samples, matrix spikes and sample duplicates are spiked with internal standards and surrogate compounds. All instrument sequences begin with an initial calibration verification standard and a blank; and excepting GC/MS sequences, all sequences close with a continuing calibration standard. GC/MS systems are tuned to appropriate ion abundance criteria daily, or for each 12 hour operating period, whichever is more frequent.

Quality Assessment protocols for most inorganic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. Standard curves are derived from one reagent blank and four concentration levels. Curve validity is verified by standard recoveries within plus or minus ten percent of the curve.

B. Definitions

Batches are used as the basic unit for Quality Assessment. A Batch is defined as twenty or fewer samples of the same matrix which are prepared together for the same analysis, using the same lots of reagents and the same techniques or manipulations, all within the same continuum of time, up to but not exceeding 24 hours.

Laboratory Control Samples are used to assess the accuracy of the analytical method. A Laboratory Control Sample consists of reagent water or sodium sulfate spiked with a group of target analytes representative of the method analytes. Accuracy is defined as the degree of agreement of the measured value with the true or expected value. Perent Recoveries for the Laboratory Control Samples are calculated to assess accuracy.

Method Blanks are used to assess the level of contamination present in the analytical system. Method Blanks consist of reagent water or an aliquot of sodium sulfate. Method Blanks are taken through all the appropriate steps of an analytical method. Sample data reported is not corrected for blank contamination.

Surrogate Compounds are used to assess the effectiveness of an analytical method in dealing with each sample matrix. Surrogate Compounds are organic compounds which are similar to the target analytes of interest in chemical behavior, but which are not normally found in environmental samples. Percent Recoveries are calculated for each Surrogate Compound.



Quality Control Report Laboratory Control Sample

Category: **EPA Method 8260B** QC Batch ID: **VM4-2575-WL**

Matrix: Aqueous Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	10	8	83 %	70 - 130 %
71-43-2	Benzene	10	10	97 %	<i>7</i> 0 - 130 %
79-01-6	Trichloroethene	10	10	100 %	70 - 130 %
108-88-3	Toluene	10	10	97 %	70 - 130 %
108-90-7	Chlorobenzene	10	9	95 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	97 %	86 - 118 %
1,2-Dichloroethane-d ₄	100 %	80 - 120 %
Toluene-d _a	98 %	88 - 110 %
4-Bromofluorobenzene	104 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: EPA Method 8260B QC Batch ID: VM4-2575-WB Matrix: Aqueous

_CAS Number _	Analyte	Concentration -	Units	Reporting Limit
74-87-3	Chloromethane	BRL	ц g/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) ^o	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
QC \$	urrogate Compounds	Recovery		Limits
Dibromofluoromet		98 %		118 %
1,2-Dichloroethan	2-d ₄	101 %		120 %
Toluene-d ₈		98 %	88 -	110 %
4-Bromofluoroben	zene	108 %	86 -	115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

- BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.
- Indicates additional target analyte.



Quality Control Report Laboratory Control Sample

Category: **EPA Method 8260B** QC Batch ID: **VM4-2574-WL**

Matrix: Aqueous Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery :	QC Limits
75-35-4	1,1-Dichloroethene	10	9	90 %	70 - 130 %
71-43-2	Benzene	10	10	101 %	70 - 130 %
79-01-6	Trichloroethene	10 :	10	104 %	70 - 130 %
108-88-3	Toluene	10 ;	10	99 %	70 - 130 %
108-90-7	Chlorobenzene	10	10	99 %	70 - 130 %
QC S	urrogate Compounds	Recov	ery	QC Lin	ilts
Dibromofluoror	methane	97	%	86 - 118	3 %
1,2-Dichloroeth	iane-d ₄	100	%	80 - 120) %
Toluene-da		97	%	88 - 110) %
4-Bromofluornh	enzene	103	%	86 - 11	5 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: EPA Method 8260B QC Batch ID: VM4-2574-WB Matrix: Aqueous

CAS Number			Units	Reporting Limit
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L_	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
<i>75</i> -15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) 6	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachioride	BRL	u g /L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	n8/F	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	, ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ng/L	0.5
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	u g/ L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho- Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ng/r	0.5
	urrogate Compounds			Climits
Dibromofluoromet		98 %	. · 	5 - 118 %
1,2-Dichloroethane-d ₄		100 %	80) - 120 %
Toluene-d ₈		97 %	88	3 - 110 %
4-Bromofluorobenzene		109 %	. 86	5 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

٥ Indicates additional target analyte.



Quality Control Report Laboratory Control Sample

Category: Inorganic Chemistry

Matrix: Aqueous

Analyte	Method	QC Batch	Units	Spiked	Measured	Recovery	QC Limits
Nitrate (as Nitrogen)	5M 4500-NO3 F	NI-1751-W	mg/L	0.50	0.55	109 %	80 - 120 %
Ammonia (as Nitrogen)	SM 4500-NH3 BG	AM-1146-W	mg/L	5.0	5.2	103 %	80 - 120 %
Fluoride	EPA 9214	FL-0331-W	mg/L	1.0	0.97	97 %	80 - 120 %
Chloride	EPA 9056	IC-0330-W	mg/L	2.5	2.6	103 %	80 - 120 %

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), and Standard Methods for the Examination of Water and Wastewater,

APHA, Eighteenth Edition (1992).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: Inorganic Chemistry

Matrix: Aqueous

Analyte	Result	Units	Reporting Limit	QC Batch	Method
Nitrate (as Nitrogen)	BRL	mg/L	0.02	NI-1751-W	SM 4500-NO3 F
Ammonia (as Nitrogen)	BRL	mg/L	0.2	AM-1146-W	SM 4500-NH3 BG
Fluoride	BRL	mg/L	0.04	FL-0331-W	EPA 9214
Chloride	BRL	mg/L	0.6	IC-0330-W	EPA 9056

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), and Standard Methods for the Examination of Water and Wastewater,

APHA, Eighteenth Edition (1992).

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.



Certifications and Approvals

Groundwater Analytical maintains environmental laboratory certification in a variety of states. Copies of our current certificates may be obtained from our website:

http://www.groundwateranalytical.com/qualifications.htm

CONNECTICUT, Department of Health Services, PH-0586

Categories: Potable Water, Wastewater, Solid Waste and Soil

http://www.dph.state.ct.us/BRS/Environmental Lab/OutStateLabList.htm

FLORIDA, Department of Health, Bureau of Laboratories, E87643

Categories: SDWA, CWA, RCRA/CERCLA http://www.floridadep.org/labs/qa/dohforms.htm

MAINE, Department of Human Services, MA103

Categories: Drinking Water and Wastewater

http://www.state.me.us/dhs/eng/water/Compliance.htm

MASSACHUSETTS, Department of Environmental Protection, M-MA-103

Categories: Potable Water and Non-Potable Water http://www.state.ma.us/dep/bspt/wes/files/certlabs.pdf

NEW HAMPSHIRE, Department of Environmental Services, 202703

Categories: Drinking Water and Wastewater

http://www.des.state.nh.us/asp/NHELAP/labsview.asp

NEW YORK, Department of Health, 11754

Categories: Potable Water, Non-Potable Water and Solid Waste

http://www.wadsworth.org/labcert/elap/comm.html

PENNSYLVANIA, Department of Environmental Protection, 68-665

Environmental Laboratory Registration (Non-drinking water and Non-wastewater) http://www.dep.state.pa.us/Labs/Registered/

RHODE ISLAND, Department of Health, 54

Categories: Surface Water, Air, Wastewater, Potable Water, Sewage

http://www.healthri.org/labs/labsCT MA.htm

U.S. Department of Agriculture, Soil Permit, S-53921

Foreign soil import permit

VERMONT, Department of Environmental Conservation, Water Supply Division

Category: Drinking Water

http://www.vermontdrinkingwater.org/wsops/labtable.PDF



July 10, 2003

Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532

Telephone (508) 759-4441 FAX (508) 759-4475 www.groundwateranalytical.com

Ms. Christine Binger Geolnsight, Inc. 319 Littleton Rd. Suite 105 Westford, MA 01886

LABORATORY REPORT

Project:

Go Olympia/2491

Lab ID:

62378

Received:

06-25-03

Dear Christine:

Enclosed are the analytical results for the above referenced project. The project was processed for Standard turnaround.

This letter authorizes the release of the analytical results, and should be considered a part of this report. This report contains a sample receipt report detailing the samples received, a project narrative indicating project changes and non-conformances, a quality control report, and a statement of our state certifications.

The analytical results contained in this report meet all applicable NELAC standards, except as may be specifically noted, or described in the project narrative. This report may only be used or reproduced in its entirety.

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Should you have any questions concerning this report, please do not hesitate to contact me.

Sincerely,

Jonathan R. Sanford

President

JRS/smd Enclosures



Sample Receipt Report

Project: Go Olympia/2491

Client: Geolnsight, Inc.

C282935 40 mL VOA Vial Industrial

Delivery: GWA Courier

05-05-03

05-19-03

Temperature: 2.0'C Chain of Custody: Present

Airbill: n/a Lab Receipt: 06-25-03

Custody Seal(s): n/a

		7.4		a Misicil	Editor -				.bt=	
62378-1	Geo-3		Aqueous	6/24/03 10:00				_		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C282911	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03			
C282923	40 ml VOA Vial	Industrial	BX7817	HCI	R-3449R	05-05-03	05-19-03			

HCI

BX7817

gieldig.	e House			Semilary.	V. V. Lilians			Total Control of the
62378-2	Geo-4		Aqueous	6/24/03 14:50	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282914	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	
C282926	40 mL VOA Vial	Industrial	BX7817	HCl	R-3449B	05-05-03	05-19-03	
C282938	40 mL VOA Vial	Industrial	BX7817	HCl	R-3449B	05-05-03	05-19-03	

R-3449B

- diabito e	Line Michael ID		. Lii.	: Isamplet	Meliodes			Notes: 42 to 18 to	
62378-3	Geo-5		Aqueous	6/24/03 13:00	EPA 8260B V	olatile Organic	5		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship		
C282912	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03		
C282924	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03		
C282936	40 mL VOA Vial	Industrial	BX7817	HCl	R-3449B	05-05-03	05-19-03		

alab (D)	A MINITED F F		Matrix	esampled a	wellsof.	4, 1		Moter & S	
62378-4	Geo-6		Aqueous	6/24/03 14:10					
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship		
C282954	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03		
C282978	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03		
C282966	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03		

-Labip 2			e Matrix	i Stoped	e Melliqua			The Cole State of the Cole Sta
62378-5	Geo-7		Aqueous	6/24/03 14:00				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282913	40 mL VOA Vial	Industrial	BX7817	HCl	R-3449B	05-05-03	05-19-03	
C282925	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	
C282937	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	

alamb g	Figure 1			amild.	"Melic!			$\psi_{i}=\psi_{i}$
62378-6	Test-1		Aqueous	6/24/03 15:30				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282965	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	
C282953	40 mL VOA Vial	Industrial	BX7817	HCl	R-3449B	05-05-03	05-19-03	
C282977	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	

STAINID	a stando en			existingleries	/ Xenixer			Mile the second second second
62378-7	Geo-5		Aqueous	6/24/03 13:00	EPA 6010B F	e Mn Total		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C299238	250 mt Plastic	Proline	BX7117	HNO3	R-3518)	04-09-03	04-22-03	

Clabii D	#//Farield/ID-		Matrix	Sampled	Method	16.9		Social La	
62378-8	Geo-3		Aqueous	6/24/03 10:00	EPA 6010B	Fe Mn Dissolved	l		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship		
C261854	250 mL Plastic	Proline	BX5680	HNO3	R-3380E	10-22-02	11-13-02		
C226574	250 mL Plastic	Proline	BX6598	HNO3	R-3518J	02-20-03	03-14-03		



Sample Receipt Report (Continued)

Project: Go Olympia/2491 Client: GeoInsight, Inc. Lab ID: 62378

Delivery: GWA Courier Airbill: n/a

Temperature: 2.0'C Chain of Custody: Present

Lab Receipt: 06-25-03

Custody Seal(s): n/a

Lab ID	Field ID		Matrix	Sampled	Method			Notes
62378-9	Geo-4			6/24/03 14:50	6/24/03 14:50 EPA 6010B Fe Mn Dissolved			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C273863	250 mL Plastic	Proline	BX6595	HNO3	R-3518J	01-21-03	02-06-03	
C226604	250 mL Plastic	Proline	BX6598	HNO3	R-3518J	02-19-03	03-14-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
62378-10	Geo-5		Aqueous	6/24/03 13:00 EPA 6010B Fe Mn Dissolved				
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C226568	250 mL Plastic	Proline	BX6598	HNO3	R-3518J	02-20-03	03-14-03	
C299241	250 mL Plastic	Proline	BX7117	HNO3	R-3518J	04-09-03	04-22-03	



EPA Method 8260B Volatile Organics by GC/MS

Field ID:

Geo-3

Project: Client: Go Olympia/2491 GeoInsight, Inc. 40 mL VOA Vial

Container: Preservation: Matrix:

HCI / Cool Aqueous Laboratory ID:

ID: 62378-01

1

QC Batch ID: Sampled: VM5-2581-W 06-24-03

Received: Analyzed: 06-25-03 06-30-03

Dilution Factor:

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Lin
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	35	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	0.7	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis- 1,2-Dichloroethene	49	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	4	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	14	ug/L	0.5



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID: Geo-3
Project: Go Olympia/2491

Client: Geolnsight, Inc.
Container: 40 mL VOA Vial

Preservation: HCI / Cool

Matrix: Aqueous

Laboratory ID: 62378-01

QC Batch ID: VM5-2581-W Sampled: 06-24-03

Received: **06-25-03** Analyzed: **06-30-03**

Dilution Factor: 1

Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	47	ug/L	0.5
95-47-6	ortho-Xylene	18	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	3	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n-Propylbenzene	3	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	5	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert- Butylbenzene	BRL	ug/L	0.5
9.5-63-6	1,2,4-Trimethylbenzene	14	ug/L	0.5
135-98-8	sec-Butylbenzene	2	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	2	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	7	ug/L	0.5
104-51-8	n -Butylbenzene	2	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	98 %	80 - 120 %
Toluene-d ₈	103 %	88 - 110 %
4-Bromofluorobenzene	102 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

RL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



EPA Method 8260B Volatile Organics by GC/MS

Field ID:

Geo-4

Project: Go Olympia/2491

Client: Container: Preservation:

GeoInsight, Inc. 40 mL VOA Vial HCI / Cool

Matrix:

Aqueous

Laboratory ID:

62378-02

QC Batch ID: Sampled:

VM5-2581-W

Received: Analyzed: 06-24-03 06-25-03 06-30-03

Dilution Factor:

10

1 of 2 Page:

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	5
74-87-3	Chloromethane	BRL	ug/L	5
75-01-4	Vinyl Chloride	BRL	ug/L	5
74-83-9	Bromomethane	BRL	ug/L	5
75-00-3	Chloroethane	BRL	ug/L	5
75-69-4	Trichlorofluoromethane	BRL	ug/L	5
60-29-7	Diethyl Ether	BRL	ug/L	20
75-35-4	1,1-Dichloroethene	BRL	ug/L	5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	50
67-64-1	Acetone	BRL	ug/L	100
75-15-0	Carbon Disulfide	BRL	ug/L	50
75-09-2	Methylene Chloride	BRL	ug/L	25
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	5
75-34-3	1,1-Dichloroethane	BRL	ug/L	5
590-20-7	2,2-Dichloropropane	BRL	ug/L	5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	5
78-93-3	2-Butanone (MEK)	BRL	ug/L	50
74-97-5	Bromochloromethane	BRL	ug/L	5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	50
67-66-3	Chloroform	BRL	ug/L	5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	5
56-23-5	Carbon Tetrachloride	BRL	ug/L	5
563-58-6	1,1-Dichloropropene	BRL	ug/L	5
71-43-2	Benzene	BRL	ug/L	5
107-06-2	1,2-Dichloroethane	BRL	ug/L	5
79-01-6	Trichloroethene	340	ug/L	5
78-87-5	1,2-Dichloropropane	BRL	ug/L	5
74-95-3	Dibromomethane	BRL	ug/L	5
75-27-4	Bromodichloromethane	BRL	ug/L	5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	50
108-88-3	Toluene	BRL	ug/L	5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	5
127-18-4	Tetrachloroethene	BRL	ug/L	5
142-28-9	1,3-Dichloropropane	BRL	ug/L	5
591-78-6	2-Hexanone	BRL	ug/L	50
124-48-1	Dibromochloromethane	BRL	ug/L	5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	5
108-90-7	Chlorobenzene	BRL	ug/L	5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	5
100-41-4	Ethylbenzene	BRL	ug/L	5



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID:

Geo-4

Laboratory ID:

62378-02

Project:

Go Olympia/2491

QC Batch ID:

VM5-2581-W

Client:

Geolnsight, Inc.

Sampled:

06-24-03

Container: Preservation: 40 mL VOA Vial

Received:

06-25-03

reservati

HCI / Cool

Analyzed: Dilution Factor: 06-30-03

Matrix: Aqueous

Diluti

r: 10

Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	5
95-47-6	ortho- Xylene	BRL	ug/L	5
100-42-5	Styrene	BRL	ug/L	5
75-25-2	Bromoform	BRL	ug/L	5
98-82-8	Isopropylbenzene	BRL	ug/L	5
108-86-1	Bromobenzene	BRL	ug/L	5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	5
103-65-1	n -Propylbenzene	BRL	ug/L	5
95-49-8	2-Chlorotoluene	BRL	ug/L	5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	5
106-43-4	4-Chlorotoluene	BRL	ug/L	5
98-06-6	tert-Butylbenzene	BRL	ug/L	5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	5
135-98-8	sec -Butylbenzene	BRL	ug/L	5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	5
99-87-6	4-Isopropyltoluene	BRL	ug/L	5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	5
104-51-8	n -Butylbenzene	BRL	ug/L	5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	5
87-68-3	Hexachlorobutadiene	BRL	ug/L	5
91-20-3	Naphthalene	BRL	ug/L	5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	5

QC Surrogate Compounds	rogate Compounds Recovery	
Dibromofluoromethane	97 %	86 - 118 %
1,2-Dichloroethane-d ₄	99 %	80 - 120 %
Toluene-d ₈	102 %	88 - 110 %
4-Bromofluorobenzene	106 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

RL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



EPA Method 8260B Volatile Organics by GC/MS

Field ID:

Geo-5

Project: Go Olympia/2491 Client: GeoInsight, Inc.

Container: Preservation:

Matrix:

40 mL VOA Vial HCl / Cool Aqueous Laboratory II

Laboratory ID: QC Batch ID: 62378-03 VM5-2581-W

Sampled: 06-24-03 Received: 06-25-03 Analyzed: 06-30-03 Dilution Factor: 100

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Lim
75-71-8	Dichlorodifluoromethane	BRL	ug/L	50
74-87-3	Chloromethane	BRL	ug/L	50
75-01-4	Vinyl Chloride	BRL	ug/L	50
74-83-9	Bromomethane	BRL	ug/L	50
75-00-3	Chloroethane	BRL	ug/L	50
75-69-4	Trichlorofluoromethane	BRL	ug/L	50
60-29-7	Diethyl Ether	BRL	ug/L	200
75-35-4	1,1-Dichloroethene	BRL	ug/L	50
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	500
67-64-1	Acetone	BRL	ug/L	1,000
75-15-0	Carbon Disulfide	BRL	ug/L	500
75-09-2	Methylene Chloride	BRL	ug/L	250
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	50
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	50
75-34-3	1,1-Dichloroethane	BRL	ug/L	50
590-20-7	2,2-Dichloropropane	BRL	ug/L	50
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	50
78-93-3	2-Butanone (MEK)	BRL	ug/L	500
74-97-5	Bromochloromethane	BRL	ug/L	50
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	500
67-66-3	Chloroform	BRL	ug/L	50
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	50
56-23-5	Carbon Tetrachloride	BRL	ug/L	50
563-58-6	1,1-Dichloropropene	BRL	ug/L	50
71-43-2	Benzene	BRL	ug/L	50
107-06-2	1,2-Dichloroethane	BRL	ug/L	50
79-01-6	Trichloroethene	3,300	ug/L	50
78-87-5	1,2-Dichloropropane	BRL	ug/L	50
74-95-3	Dibromomethane	BRL	ug/L	50
75-27-4	Bromodichloromethane	BRL	ug/L	50
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	50
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	500
108-88-3	Toluene	BRL	ug/L	50
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	50
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	50
127-18-4	Tetrachloroethene	280	ug/L	50
142-28-9	1,3-Dichloropropane	BRL	ug/L	50
591-78-6	2-Hexanone	BRL	ug/L	500
124-48-1	Dibromochloromethane	BRL	ug/L	50
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	50
108-90-7	Chlorobenzene	BRL	ug/L	50
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	50
100-41-4	Ethylbenzene	BRL	ug/L	50



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID:

Geo-5

Project:

Go Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation:

HCI / Cool

Matrix:

Aqueous

Laboratory ID:

62378-03

QC Batch ID:

VM5-2581-W

Sampled:

06-24-03

Received:

06-25-03

Analyzed: Dilution Factor: 06-30-03

100

Page:	2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	50
95-47-6	ortho- Xylene	BRL	ug/L	50
100-42-5	Styrene	BRL	ug/L	50
75-25-2	Bromoform	BRL	ug/L	50
98-82-8	Isopropylbenzene	BRL	ug/L	50
108-86-1	Bromobenzene	BRL	ug/L	50
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	50
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	50
103-65-1	n-Propylbenzene	BRL	ug/L	50
95-49-8	2-Chlorotoluene	BRL	ug/L	50
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	50
106-43-4	4-Chlorotoluene	BRL	ug/L	50
98-06-6	tert- Butylbenzene	BRL	ug/L	50
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	50
135-98-8	sec -Butylbenzene	BRL	ug/L	50
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	50
99-87-6	4-Isopropyltoluene	BRL	ug/L	50
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	50
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	50
104-51-8	n -Butylbenzene	BRL	ug/L	50
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	50
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	50
87-68-3	Hexachlorobutadiene	BRL	ug/L	50
91-20-3	Naphthalene	BRL	ug/L	50
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	50

QC Surrogate Compounds	npounds Recovery	
Dibromofluoromethane	96 %	86 - 118 %
1,2-Dichloroethane-d ₄	98 %	80 - 120 %
Toluene-d ₈	101 %	88 - 110 %
4-Bromofluorobenzene	104 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



EPA Method 8260B Volatile Organics by GC/MS

Field ID: Project:

Geo-6

Go Olympia/2491

Client:

Geolnsight, Inc. 40 mL VOA Vial

Container: Preservation:

HCI / Cool

Matrix: Aqueous Laboratory ID:

62378-04

QC Batch ID:

VM5-2581-W

Sampled:

06-24-03 06-25-03

Received: Analyzed: 06-30-03

Dilution Factor: 1

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis- 1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID: Geo-6
Project: Go Olympia/2491
Client: GeoInsight, Inc.
Container: 40 mL VOA Vial

Preservation: HCI / Cool Matrix: Aqueous

Laboratory ID: 62378-04
QC Batch ID: VM5-2581-W

Sampled: 06-24-03 Received: 06-25-03 Analyzed: 06-30-03

Dilution Factor: 1
Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n -Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert- Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5
135-98-8	sec -Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5
104-51-8	n -Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	100 %	80 - 120 %
Toluene-d ₈	101 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



EPA Method 8260B Volatile Organics by GC/MS

Field ID:

Geo-7

Project: Client:

Go Olympia/2491 Geolnsight, Inc.

Container: Preservation: 40 mL VOA Vial HCI / Cool

Matrix:

Aqueous

Laboratory ID:

62378-05

QC Batch ID: Sampled:

VM5-2581-W 06-24-03

Received:

06-25-03

Analyzed:

07-01-03

1

Dilution Factor:

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	8	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	2	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID:

Geo-7

Go Olympia/2491

Project: Client:

Geolnsight, Inc.

Container: Preservation: 40 mL VOA Vial HCI / Cool

Matrix:

Aqueous

Laboratory ID:

62378-05

QC Batch ID:

VM5-2581-W

Sampled:

06-24-03

Received:

06-25-03

Analyzed:

07-01-03

Dilution Factor:

1

Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n -Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert- Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5
135-98-8	sec -Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5
104-51-8	n -Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	99 %	80 - 120 %
Toluene-d ₈	100 %	88 - 110 %
4-Bromofluorobenzene	105 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



EPA Method 8260B Volatile Organics by GC/MS

Field ID:

Client:

Test-1

Project:

Go Olympia/2491 GeoInsight, Inc.

Container: Preservation: 40 mL VOA Vial HCI / Cool

Matrix:

Aqueous

Laboratory ID:

QC Batch ID:

62378-06 VM5-2581-W

Sampled:

06-24-03 06-25-03

Received: Analyzed: 06-30-03

Dilution Factor: 10

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CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	5
74-87-3	Chloromethane	BRL	ug/L	5
75-01-4	Vinyl Chloride	BRL	ug/L	5
74-83-9	Bromomethane	BRL	ug/L	5
75-00-3	Chloroethane	BRL	ug/L	5
75-69-4	Trichlorofluoromethane	BRL	ug/L	5
60-29-7	Diethyl Ether	BRL	ug/L	20
75-35-4	1,1-Dichloroethene	BRL	ug/L	5
76-13-1	1,1,2-Trichlorotrifluoroethane	57	ug/L	50
67-64-1	Acetone	BRL	ug/L	100
75-15-0	Carbon Disulfide	BRL	ug/L	50
75-09-2	Methylene Chloride	BRL	ug/L	25
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	5
75-34-3	1,1-Dichloroethane	BRL	ug/L	5
590-20-7	2,2-Dichloropropane	BRL	ug/L	5
156-59-2	cis-1,2-Dichloroethene	53	ug/L	5
78-93-3	2-Butanone (MEK)	BRL	ug/L	50
74-97-5	Bromochloromethane	BRL	ug/L	5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	50
67-66-3	Chloroform	BRL	ug/L	5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	5
56-23-5	Carbon Tetrachloride	BRL	ug/L	5
563-58-6	1,1-Dichloropropene	BRL	ug/L	5
71-43-2	Benzene	BRL	ug/L	5
107-06-2	1,2-Dichloroethane	BRL	ug/L	5
79-01-6	Trichloroethene	400	ug/L	5
78-87-5	1,2-Dichloropropane	BRL	ug/L	5
74-95-3	Dibromomethane	BRL	ug/L	5
75-27-4	Bromodichloromethane	BRL	ug/L	5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	50
108-88-3	Toluene	BRL	ug/L	5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	5
127-18-4	Tetrachloroethene	BRL	ug/L	5
142-28-9	1,3-Dichloropropane	BRL	ug/L	5
591-78-6	2-Hexanone	BRL	ug/L	50
124-48-1	Dibromochloromethane	BRL	ug/L	5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	5
108-90-7	Chlorobenzene	BRL	ug/L	5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	5
100-41-4	Ethylbenzene	6	ug/L	5



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID:

Test-1

Project:

Go Olympia/2491 GeoInsight, Inc.

Client: Container:

40 mL VOA Vial HCl / Cool

Preservation: Matrix:

Aqueous

Laboratory ID:

62378-06

QC Batch ID:

VM5-2581-W

Sampled:

06-24-03

Received:

06-25-03

Analyzed: Dilution Factor: 06-30-03

Page:

10 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	5	ug/L	5
95-47-6	ortho-Xylene	BRL	ug/L	5
100-42-5	Styrene	BRL	ug/L	5
75-25-2	Bromoform	BRL	ug/L	5
98-82-8	Isopropylbenzene	BRL	ug/L	5
108-86-1	Bromobenzene	BRL	ug/L	5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	5
103-65-1	n -Propylbenzene	BRL	ug/L	5
95-49-8	2-Chlorotoluene	BRL	ug/L	5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	5
106-43-4	4-Chlorotoluene	BRL	ug/L	5
98-06-6	tert-Butylbenzene	BRL	ug/L	5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	5
135-98-8	sec-Butylbenzene	BRL	ug/L	5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	5
99-87-6	4-Isopropyltoluene	BRL	ug/L	5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	5
104-51-8	n-Butylbenzene	BRL	ug/L	5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	5
87-68-3	Hexachlorobutadiene	BRL	ug/L	5
91-20-3	Naphthalene	BRL	ug/L	5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	5

QC Surrogate Compounds	Recovery	QC Limits				
Dibromofluoromethane	95 %	86 - 118 %				
1,2-Dichloroethane-d ₄	99 %	80 - 120 %				
Toluene-d ₈	100 %	88 - 110 %				
4-Bromofluorobenzene	105 %	86 - 115 %				

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

RL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

Geo-5

Go Olympia/2491

Project: Client:

Geolnsight, Inc. 250 mL Plastic

Container:

Preservation: HNO3 / Cool

Matrix:

Aqueous

Laboratory ID: 62378-07

Sampled:

06-24-03 06-25-03

Received: Preserved:

06-24-03

CAS Number	Analyte	Concentration	Units	Reporting Limit	Analyzed	QC Batch	Method
7439-89-6	Iron, Total	72	mg/L	0.1	07-11-03	MM-1746-W	EPA 6010B
7439-96-5	Manganese, Total	5.0	mg/L	0.05	07-11-03	MM-1746-W	EPA 6010B

Method Reterence:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

Geo-3

Laboratory ID: 62378-08

Project: Client:

Go Olympia/2491 Geolnsight, Inc.

Sampled:

06-24-03 06-25-03

Container:

250 mL Plastic

Received: Preserved:

06-24-03

Preservation: HNO3 / Cool Matrix:

Aqueous

Filtered:

06-24-03

CAS Number	Analyte	Concentration	Units	Limit	Analyzed	QC Batch	Method
7439-89-6	Iron, Dissolved	7.5	mg/L	0.1	07-09-03	MN-1127-W	EPA 6010B
7439-96-5	Manganese, Dissolved	6.3	mg/L	0.05	07-09-03	MN-1127-W	EPA 6010B

Method Reference:

lest Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

Geo-4

Laboratory ID: 62378-09

Project:

Go Olympia/2491

Sampled:

06-24-03

Client:

Geolnsight, Inc.

Received: Preserved: 06-25-03 06-24-03

Container:

250 mL Plastic Preservation: HNO3 / Cool

Filtered:

06-24-03

Matrix:

Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Limit	Analyzed	QC Batch	Method
7439-89-6	Iron, Dissolved	2.4	mg/L	0.1	07-09-03	MN-1127-W	EPA 6010B
7439-96-5	Manganese, Dissolved	6.3	mg/L	0.05	07-09-03	MN-1127-W	EPA 6010B

Method Reterence:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

Geo-5

Laboratory ID: 62378-10

Project: Client:

Go Olympia/2491 Geolnsight, Inc.

Iron, Dissolved

Analyte

Sampled: Received: 06-24-03 06-25-03

Container:

CAS Number

7439-89-6

250 mL Plastic

Preserved:

06-24-03

Preservation: HNO3 / Cool

Analyzed

07-09-03

07-09-03

QC Batch

MN-1127-W

MN-1127-W

Method

EPA 6010B

EPA 6010B

Matrix:

Aqueous

Filtered: 06-24-03

7439-96-5 Manganese, Dissolved Method Reference:

lest Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Units

mg/L

mg/L

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.

Reporting

Limit

0.1

0.05

BRL

Concentration

1.6



Project Narrative

Project: Client: Go Olympia/2491 Geolnsight, Inc. Lab ID:

62378

Received:

06-25-03 18:30

A. Documentation and Client Communication

The following documentation discrepancies, and client changes or amendments were noted for this project:

No discrepancies, changes, or amendments were noted.

B. Method Non-Conformances

The following method non-conformances were noted for this project:

No method non-conformances were noted.

GROUNDWATER ANALYTICAL	228 Main Street, P.O Buzzards Bay, MA 0 Telephone (508) 759 www.groundwateran	2532 -4441 • FAX (508) 759-4475	1,370,100	AIN-OI D WOF			Y RECORD										H					N	ļ0 0	742	216	
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Project Number:	Address: GTT	LETON RO	☐ RUS	ORITY (5 B H (RAN requires Rust			or)	OPTIONS	C) TiC Search		C Acid Only C BAN Only C TIC Search				Specify For Water Samples CT Total						Sections.	Marry, Prescovity				
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Quality Assurance/Quality Control

A. Program Overview

Groundwater Analytical conducts an active Quality Assurance program to ensure the production of high quality, valid data. This program closely follows the guidance provided by *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, US EPA QAMS-005/80 (1980), and *Test Methods for Evaluating Solid Waste*, US EPA, SW-846, Update III (1996).

Quality Control protocols include written Standard Operating Procedures (SOPs) developed for each analytical method. SOPs are derived from US EPA methodologies and other established references. Standards are prepared from commercially obtained reference materials of certified purity, and documented for traceability.

Quality Assessment protocols for most organic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. All samples, standards, blanks, laboratory control samples, matrix spikes and sample duplicates are spiked with internal standards and surrogate compounds. All instrument sequences begin with an initial calibration verification standard and a blank; and excepting GC/MS sequences, all sequences close with a continuing calibration standard. GC/MS systems are tuned to appropriate ion abundance criteria daily, or for each 12 hour operating period, whichever is more frequent.

Quality Assessment protocols for most inorganic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. Standard curves are derived from one reagent blank and four concentration levels. Curve validity is verified by standard recoveries within plus or minus ten percent of the curve.

B. Definitions

Batches are used as the basic unit for Quality Assessment. A Batch is defined as twenty or fewer samples of the same matrix which are prepared together for the same analysis, using the same lots of reagents and the same techniques or manipulations, all within the same continuum of time, up to but not exceeding 24 hours.

Laboratory Control Samples are used to assess the accuracy of the analytical method. A Laboratory Control Sample consists of reagent water or sodium sulfate spiked with a group of target analytes representative of the method analytes. Accuracy is defined as the degree of agreement of the measured value with the true or expected value. Perent Recoveries for the Laboratory Control Samples are calculated to assess accuracy.

Method Blanks are used to assess the level of contamination present in the analytical system. Method Blanks consist of reagent water or an aliquot of sodium sulfate. Method Blanks are taken through all the appropriate steps of an analytical method. Sample data reported is not corrected for blank contamination.

Surrogate Compounds are used to assess the effectiveness of an analytical method in dealing with each sample matrix. Surrogate Compounds are organic compounds which are similar to the target analytes of interest in chemical behavior, but which are not normally found in environmental samples. Percent Recoveries are calculated for each Surrogate Compound.



Quality Control Report Laboratory Control Sample

Category: EPA Method 8260B

QC Batch ID: VM5-2581-WL

Matrix: Aqueous

Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	10	9	87 %	70 - 130 %
71-43-2	Benzene	10	10	98 %	70 - 130 %
79-01-6	Trichloroethene	10	10	96 %	70 - 130 %
108-88-3	Toluene	10	10	98 %	70 - 130 %
108-90-7	Chlorobenzene	10	10	98 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits			
Dibromofluoromethane	97 %	86 - 118 %			
1,2-Dichloroethane-d ₄	101 %	80 - 120 %			
Toluene-d ₈	101 %	88 - 110 %			
4-Bromofluorobenzene	102 %	86 - 115 %			

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: EPA Method 8260B
QC Batch ID: VM5-2581-WB
Matrix: Aqueous

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5



Quality Control Report Method Blank

Category: EPA Method 8260B QC Batch ID: VM5-2581-WB

Matrix: Aqueous Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho- Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n-Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert-Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5
135-98-8	sec-Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5
104-51-8	n-Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	96 %	86 - 118 %
1,2-Dichloroethane-d ₄	97 %	80 - 120 %
Toluene-d ₈	101 %	88 - 110 %
4-Bromofluorobenzene	104 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Quality Control Report Laboratory Control Sample

Category: Matrix: Metals Aqueous

CAS Number	Analyte	Method	QC Batch	Units	Spiked	Measured	Recovery	QC Limits
7439-89-6	Iron	6010B	MN-1127-W	mg/L	1.0	1.0	100 %	80-120 %
7439-96-5	Manganese	6010B	MN-1127-W	mg/L	1.0	1.0	100 %	80-120 %

Method References: Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: Matrix: Metals Aqueous

CAS Number	Analyte	Result	Units	Reporting Limit	QC Batch	Method
7439-89-6	Iron	BRL	mg/L	0.1	MN-1127-WB	6010B
7439-96-5	Manganese	BRL	mg/L	0.05	MN-1127-WB	6010B

Method References: Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Update III (1996).

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Quality Control Report Laboratory Control Sample

Category: Metals Matrix: Aqueous

CAS Number	Analyte	Method	QC Batch	Units	Spiked	Measured	Recovery	QC Limits
7439-89-6	Iron	6010B	MM-1746-W	mg/L	1.0	1.1	106 %	80-120 %
7439-96-5	Manganese	6010B	MM-1746-W	mg/L	1.0	1.0	100 %	80-120 %

Method References: Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category:

Metals

Matrix:

Aqueous

CAS Number	Analyte	Result	Units	Reporting Limit	QC Batch	Method
7439-89-6	Iron	BRL	mg/L	0.10	MM-1746-WB	6010B
7439-96-5	Manganese	BRL	mg/L	0.05	MM-1746-WB	6010B

Method References:

Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Update III (1996).

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Certifications and Approvals

Groundwater Analytical maintains environmental laboratory certification in a variety of states. Copies of our current certificates may be obtained from our website:

http://www.groundwateranalytical.com/qualifications.htm

CONNECTICUT, Department of Health Services, PH-0586

Categories: Potable Water, Wastewater, Solid Waste and Soil

http://www.dph.state.ct.us/BRS/Environmental_Lab/OutStateLabList.htm

FLORIDA, Department of Health, Bureau of Laboratories, E87643

Categories: SDWA, CWA, RCRA/CERCLA http://www.floridadep.org/labs/qa/dohforms.htm

MAINE, Department of Human Services, MA103

Categories: Drinking Water and Wastewater

http://www.state.me.us/dhs/eng/water/Compliance.htm

MASSACHUSETTS, Department of Environmental Protection, M-MA-103

Categories: Potable Water and Non-Potable Water http://www.state.ma.us/dep/bspt/wes/files/certlabs.pdf

NEW HAMPSHIRE, Department of Environmental Services, 202703

Categories: Drinking Water and Wastewater

http://www.des.state.nh.us/asp/NHELAP/labsview.asp

NEW YORK, Department of Health, 11754

Categories: Potable Water, Non-Potable Water and Solid Waste

http://www.wadsworth.org/labcert/elap/comm.html

PENNSYLVANIA, Department of Environmental Protection, 68-665

Environmental Laboratory Registration (Non-drinking water and Non-wastewater) http://www.dep.state.pa.us/Labs/Registered/

RHODE ISLAND, Department of Health, 54

Categories: Surface Water, Air, Wastewater, Potable Water, Sewage

http://www.healthri.org/labs/labsCT_MA.htm

U.S. Department of Agriculture, Soil Permit, S-53921

Foreign soil import permit

VERMONT, Department of Environmental Conservation, Water Supply Division

Category: Drinking Water

http://www.vermontdrinkingwater.org/wsops/labtable.PDF

May 7, 2003

Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532

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Mr. Kevin Trainer GeoInsight, Inc. 319 Littleton Rd. Suite 105 Westford, MA 01886

LABORATORY REPORT

Project:

60 Olympia/2491

Lab ID:

60611 04-30-03

Received: Dear Kevin:

Enclosed are the analytical results for the above referenced project. The project was processed for Priority turnaround.

This letter authorizes the release of the analytical results, and should be considered a part of this report. This report contains a sample receipt report detailing the samples received, a project narrative indicating project changes and non-conformances, a quality control report, and a statement of our state certifications.

The analytical results contained in this report meet all applicable NELAC standards, except as may be specifically noted, or described in the project narrative. This report may only be used or reproduced in its entirety.

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Should you have any questions concerning this report, please do not hesitate to contact me.

Sincerely,

Eric H. Jensen

Operations Manager

EHJ/pcl Enclosures



Sample Receipt Report

Project: 60 Olympia/2491 Client: Geolnsight, Inc.

Lab ID: 60611

Delivery: GWA Courier

Airbill: n/a

Lab Receipt: 04-30-03

Temperature: 3.0'C Chain of Custody: Present

Lab ID	Field 1D		Matrix	Sampled	Method	The her cally		Notes
60611-1	GEO-SB-101D		Aqueous	4/28/03 11:05	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247089	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247101	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247113	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	The second secon

Lab ID	Field ID		Matrix	Sampled	Method	148		Notes
60611-2	GEO-SB-101E		Aqueous	4/28/03 11:30	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247117	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247129	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247141	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	MIKO Law Committee of the law of

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-3	GEO-SB-101F		Aqueous	4/28/03 11:55	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247120	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	the state of the s
C247132	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247144	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	

Lab ID	Field 1D		Matrix	Sampled	Method			Notes
60611-4	GEO-SB-100C		Aqueous	4/28/03 13:45	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247088	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247100	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247106	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	

Lab ID	Field ID		Matrix	Sampled	Method		The state of the state of	Notes
60611-5	GEO-SB-100D		Aqueous	4/28/03 14:00	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247118	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247142	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247130	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-6	1-6 GEO-SB-103D Aqueous 4/25/03 12:30 EPA 8260B TCL Volatile Organics							
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247099	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247111	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247087	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	

Lab ID	CONTROL CONTRO		Matrix	Sampled	Method	THE VENT		Notes
60611-7			Aqueous	4/25/03 13:00	EPA 8260B T			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C269251	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03	
C269287	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03	
C269239	40 mL VOA Vial	Industrial	BX7101	HCI	R-3173F	03-14-03	03-24-03	Street Street



Project: 60 Olympia/2491 Client: GeoInsight, Inc. Delivery: GWA Courier
Airbill: n/a

Temperature: 3.0'C Chain of Custody: Present

Lab ID: 60611

Lab Receipt: 04-30-03

Lab ID	Field ID		Matrix	Sampled	Method	Mark Name	理性制法性心。其	Notes
60611-8	GEO-SB-102D		Aqueous	4/25/03 14:52	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247091	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247103	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247115	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-9	GEO-SB-102E		Aqueous	4/25/03 15:30	EPA 8260B T	CL Volatile Org	anics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C247128	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247140	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	
C247116	40 mL VOA Vial	Industrial	BX7380	HCI	R-3173F	03-27-03	04-04-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-10	0611-10 GEO-SB-101A			4/28/03 9:50	EPA 8260B TO	L Volatile Org		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C288973	40 mL VOA Vial	n/a	n/a	Methanol	n/a	n/a	n/a	
C288972	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288971	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288970	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	

Lab ID	Field ID		Matrix	Sampled	Method		Factor F	Notes
60611-11	GEO-SB-101B		Soil	4/28/03 10:10	EPA 8260B TO	CL Volatile Org	anics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C087441	40 mL VOA Vial	Industrial	BX1545	Methanol	R-3245AU	12-20-01	04-04-02	
C019374	40 mL VOA Vial	Industrial	BX2800	NaHSO4	R-3170C	03-13-02	04-04-02	
C019373	40 mL VOA Vial	Industrial	BX2800	NaHSO4	R-3170C	03-13-02	04-04-02	
C019372	40 mL VOA Vial	Industrial	BX2800	NaHSO4	R-3170C	03-13-02	04-04-02	

Lab ID	ab ID Field ID Ma		Matrix	Sampled	Method		Notes	
60611-12	GEO-SB-101C		Soil	4/28/03 10:45	EPA 8260B TCL Volatile Organics			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C079253	40 mL VOA Vial	Industrial	BX2778	Methanol	R-3306V	02-22-02	07-24-02	
C124995	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C124999	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C124996	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-13	GEO-SB-100A		Soil	4/28/03 13:15	EPA 8260B TO	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C087453	40 mL VOA Vial	Industrial	BX1545	Methanol	R-3245AU	12-20-01	04-04-02	
C019390	40 mL VOA Vial	Industrial	BX2800	NaHSO4	R-3170C	03-13-02	04-04-02	
C019391	40 mL VOA Vial	Industrial	BX2800	NaHSO4	R-3170C	03-13-02	04-04-02	
C019392	40 mL VOA Vial	Industrial	BX2800	NaHSO4	R-3170C	03-13-02	04-04-02	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-14	60611-14 GEO-SB-100B		Soil	4/28/03 13:30	EPA 8260B TO	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C079300	40 mL VOA Vial	Industrial	BX2778	Methanol	R-3306V	02-22-02	07-24-02	
C126020	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C126021	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C126019	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	



Project: 60 Olympia/2491 Client: Geolnsight, Inc. Lab ID: 60611

Delivery: GWA Courier

Temperature: 3.0'C

Airbill: n/a Lab Receipt: 04-30-03 Chain of Custody: Present

Lab ID	Field ID Matrix		Sampled	Method			Notes	
60611-15	GEO-SB-103A		Soil	4/25/03 10:50	:50 EPA 8260B TCL Volatile Organics			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C288992	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288991	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288990	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288989	40 mL VOA Vial	n/a	n/a	Methanol	n/a	n/a	n/a	

Lab ID	Field ID Matrix Sampled Method				Notes			
60611-16 GEO-SB-103B			Soil	4/25/03 11:30	EPA 8260B TO	CL Volatile Org		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C079294	40 mL VOA Vial	Industrial	BX2778	Methanol	R-3306V	02-22-02	07-24-02	
C124991	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C124989	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C124990	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-17	GEO-SB-103C		Soil	4/25/03 11:53	EPA 8260B TO	CL Volatile Org	anics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C124988	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C124987	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C124986	40 mL VOA Vial	Industrial	BX4064	NaHSO4	R-3356B	06-17-02	07-24-02	
C079289	40 mL VOA Vial	Industrial	BX2778	Methanol	R-3306V	02-22-02	07-24-02	

Lab ID	Lab ID Field ID		Matrix	Sampled	Method			Notes
60611-18	GEO-SB-102A	Soil	4/25/03 13:58	EPA 8260B TC	L Volatile Org	ganics		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C288982	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288981	40 mL VOA Vial	n/a	n/a	NaH5O4	n/a	n/a	n/a	
C288980	40 mL VOA Vial	n/a	n/a	Methanol	n/a	n/a	n/a	
C288978	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-19	GEO-SB-102B		Soil	4/25/03 14:10	EPA 8260B TC	L Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C288987	40 mL VOA Vial	n/a	n/a	NaH5O4	n/a	n/a	n/a	
C288986	40 mL VOA Vial	n/a	n/a	Methanol	n/a	n/a	n/a	
C288983	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288985	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	

Lab ID	Field ID	Total St	Matrix	Sampled	Method			Notes
60611-20 GEO-SB-102C			Soil	4/25/03 14:23	EPA 8260B T	CL Volatile Org		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C005920	40 mL VOA Vial	Industrial	BX2421	Methanol	R-3245V	01-30-02	06-10-02	
C108686	40 mL VOA Vial	Industrial	BX3588	NaHSO4	R-3356B	05-29-02	06-10-02	
C108685	40 mL VOA Vial	Industrial	BX3588	NaHSO4	R-3356B	05-29-02	06-10-02	
C108330	40 mL VOA Vial	Industrial	BX3586	NaHSO4	R-3356B	05-29-02	06-10-02	



Project: 60 Olympia/2491 Client: GeoInsight, Inc. Delivery: GWA Courier Airbill: n/a

Temperature: 3.0'C Chain of Custody: Present

Lab ID: 60611

Lab Receipt: 04-30-03

Lab ID	Field ID		Matrix	Sampled	Method		The state of the s	Notes
60611-21	GEO-SB-98		Soil	4/28/03 15:50	EPA 8260B T	CL Volatile Org	ganics	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C288977	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288975	40 mL VOA Vial	n/a	n/a	NaHSO4	n/a	n/a	n/a	
C288976	40 mL VOA Vial	n/a	n/a	Methanol	n/a	n/a	n/a	
C288974	40 ml VOA Vial	n/a	n/a	NoHsO4	n/a	n/a	n/a	

Lab 1D	Lab 1D Field ID 60611-22 GEO-SB-101A		Matrix	Sampled	Method			Notes
60611-22			Soil	4/28/03 9:50	EPA 9060 Mod	d Total Organ		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237164	250 mL Glass	Proline	BX7563	None	n/a	n/a	04-23-03	

Lab ID	Field ID		Matrix	Sampled	Method	200		Notes	第二十年之一年1
60611-23	GEO-SB-101B		Soil	4/28/03 10:10	EPA 9060 Mo	d Total Organ	ic Carbon		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship		
C237166	250 mL Glass	Proline	BX7563	None	n/a	n/a	04-23-03		

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-24	60611-24 GEO-SB-101C			4/28/03 10:45	EPA 9060 Mod			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237161	250 mL Glass	Proline	BX7563	None	n/a	n/a	04-23-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-25	GEO-SB-100A		Soil	4/28/03 13:15	EPA 9060 Mod			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237162	250 mL Glass	Proline	BX7563	None	n/a	n/a	04-23-03	

Lab ID	Field ID		Matrix	Sampled	Method		world by the state of	Notes
60611-26	GEO-SB-100B		Soil	4/28/03 13:30	EPA 9060 Mod	d Total Organ	ic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237163	250 mL Glass	Proline	BX7563	None	n/a	n/a	04-23-03	

Lab ID	Field ID	The state of	Matrix	Sampled	Method	機構創設		Notes
60611-27	GEO-SB-103B		Soil	4/25/03 11:30	EPA 9060 Mod	d Total Organ	nic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237807	250 mL Glass	Proline	BX7508	None	n/a	n/a	04-23-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-28	GEO-SB-103C	D-SB-103C Soil 4/25/03 11:53 EPA 9060 Mod Total Organic Carbon						
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237806	250 mL Glass	Proline	BX7508	None	n/a	n/a	04-23-03	

Lab ID	Field ID	212	Matrix	Sampled	Method			Notes
60611-29	GEO-SB-102A		Soil	4/25/03 13:58	EPA 9060 Mod	d Total Organ	ic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237812	250 mL Glass	Proline	BX7508	None	n/a	n/a	04-23-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-30	GEO-SB-102B		Soil	4/25/03 14:10	EPA 9060 Mod	d Total Organ	ic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237815	250 mL Glass	Proline	BX7508	None	n/a	n/a	04-23-03	



Project: 60 Olympia/2491 Client: GeoInsight, Inc. Lab ID: 60611

Delivery: GWA Courier

Temperature: 3.0'C Chain of Custody: Present

Airbill: n/a

Lab Receipt: 04-30-03

Lab ID	Field ID		Matrix	Sampled	Method			Notes
60611-31	GEO-SB-102C		Soil	4/25/03 14:23	EPA 9060 Mod	Total Organ	nic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237813	250 mL Glass	Proline	BX7508	None	n/a	n/a	04-23-03	

Lab ID	Field ID		Matrix	Sampled	Method	A FEEL		Notes
60611-32	GEO-SB-98		Soil	4/28/03 15:50	EPA 9060 Mod	d Total Organ	nic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C237170	250 mL Glass	Proline	BX7562	None	n/a	n/a	04-23-03	



Laboratory ID: 60611-01 Field ID: GEO-SB-101D QC Batch ID: Project: 60 Olympia/2491 VM5-2519-W Sampled: Client: Geolnsight, Inc. 04-28-03 04-30-03 Container: 40 mL VOA Vial Received: 05-05-03 Analyzed: Preservation: HCl / Cool Dilution Factor: 200 Matrix: Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/L	100
75-01-4	Vinyl Chloride	BRL	ug/L	100
74-83-9	Bromomethane	BRL	ug/L	100
75-00-3	Chloroethane	BRL	ug/L	100
75-35-4	1,1-Dichloroethene	BRL	ug/L	100
67-64-1	Acetone	BRL	ug/L	2,000
75-15-0	Carbon Disulfide	BRL	ug/L	1,000
75-09-2	Methylene Chloride	BRL	ug/L	500
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	100
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	100
75-34-3	1,1-Dichloroethane	BRL	ug/L	100
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	100
78-93-3	2-Butanone (MEK)	BRL	ug/L	1,000
67-66-3	Chloroform	BRL	ug/L	100
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	100
56-23-5	Carbon Tetrachloride	BRL	ug/L	100
71-43-2	Benzene	BRL	ug/L	100
107-06-2	1,2-Dichloroethane	BRL	ug/L	100
79-01-6	Trichloroethene	4,700	ug/L	100
78-87-5	1,2-Dichloropropane	BRL	ug/L	100
75-27-4	Bromodichloromethane	BRL	ug/L	100
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	100
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	1,000
108-88-3	Toluene	BRL	ug/L	100
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	100
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	100
127-18-4	Tetrachloroethene	BRL	ug/L	100
591-78-6	2-Hexanone	BRL	ug/L	1,000
124-48-1	Dibromochloromethane	BRL	ug/L	100
108-90-7	Chlorobenzene	BRL	ug/L	100
100-41-4	Ethylbenzene	BRL	ug/L	100
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	100
95-47-6	ortho-Xylene	BRL	ug/L	100
100-42-5	Styrene	BRL	ug/L	100
75-25-2	Bromoform	BRL	ug/L	100
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	100

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	93 %	80 - 120 %
Toluene-d ₈	98 %	88 - 110 %
4-Bromofluorobenzene	99 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis

performed utilizing 25mL sample purge volume.

Report Notations: BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID: GEO-SB-101E Laboratory ID: 60611-02 QC Batch ID: VM5-2519-W 60 Olympia/2491 Project: Sampled: 04-28-03 Client: Geolnsight, Inc. 40 mL VOA Vial Received: 04-30-03 Container: HCI / Cool Analyzed: 05-05-03 Preservation: Matrix: Aqueous Dilution Factor: 2,000

CAS Number	Analyte	Concentration	Units	Reporting Limit
74-87-3	Chloromethane	BRL	ug/L	1,000
75-01-4	Vinyl Chloride	BRL	ug/L	1,000
74-83-9	Bromomethane	BRL	ug/L	1,000
75-00-3	Chloroethane	BRL	ug/L	1,000
75-35-4	1,1-Dichloroethene	BRL	ug/L	1,000
67-64-1	Acetone	BRL	ug/L	20,000
75-15-0	Carbon Disulfide	BRL	ug/L	10,000
75-09-2	Methylene Chloride	BRL	ug/L	5,000
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	1,000
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	1,000
75-34-3	1,1-Dichloroethane	BRL	ug/L	1,000
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	1,000
78-93-3	2-Butanone (MEK)	BRL	ug/L	10,000
67-66-3	Chloroform	BRL	ug/L	1,000
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	1,000
56-23-5	Carbon Tetrachloride	BRL	ug/L	1,000
71-43-2	Benzene	BRL	ug/L	1,000
107-06-2	1,2-Dichloroethane	BRL	ug/L	1,000
79-01-6	Trichloroethene	47,000	ug/L	1,000
78-87-5	1,2-Dichloropropane	BRL	ug/L	1,000
75-27-4	Bromodichloromethane	BRL	ug/L	1,000
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	1,000
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	10,000
108-88-3	Toluene	BRL	ug/L	1,000
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	1,000
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	1,000
127-18-4	Tetrachloroethene	BRL	ug/L	1,000
591-78-6	2-Hexanone	BRL	ug/L	10,000
124-48-1	Dibromochloromethane	BRL	ug/L	1,000
108-90-7	Chlorobenzene	BRL	ug/L	1,000
100-41-4	Ethylbenzene	BRL	ug/L	1,000
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	1,000
95-47-6	ortho-Xylene	BRL	ug/L	1,000
100-42-5	Styrene	BRL	ug/L	1,000
75-25-2	Bromoform	BRL	ug/L	1,000
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	1,000

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	106 %	86 - 118 %
1,2-Dichloroethane-d ₄	104 %	80 - 120 %
Toluene-d ₈	108 %	88 - 110 %
4-Bromofluorobenzene	111 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-101F

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation: Matrix:

HCI / Cool Aqueous

Laboratory ID:

60611-03

QC Batch ID:

VM5-2519-W 04-28-03

Sampled: Received:

04-30-03

Analyzed:

05-05-03

Dilution Factor:

1,000

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/L	500
75-01-4	Vinyl Chloride	BRL	ug/L	500
74-83-9	Bromomethane	BRL	ug/L	500
75-00-3	Chloroethane	BRL	ug/L	500
75-35-4	1,1-Dichloroethene	BRL	ug/L	500
67-64-1	Acetone	BRL	ug/L	10,000
75-15-0	Carbon Disulfide	BRL	ug/L	5,000
75-09-2	Methylene Chloride	BRL	ug/L	2,500
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	500
1634-04-4	Methyl tert- butyl Ether (MTBE)	BRL	ug/L	500
75-34-3	1,1-Dichloroethane	BRL	ug/L	500
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	500
78-93-3	2-Butanone (MEK)	BRL	ug/L	5,000
67-66-3	Chloroform	BRL	ug/L	500
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	500
56-23-5	Carbon Tetrachloride	BRL	ug/L	500
71-43-2	Benzene	BRL	ug/L	500
107-06-2	1,2-Dichloroethane	BRL	ug/L	500
79-01-6	Trichloroethene	28,000	ug/L	500
78-87-5	1,2-Dichloropropane	BRL	ug/L	500
75-27-4	Bromodichloromethane	BRL	ug/L	500
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	500
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5,000
108-88-3	Toluene	BRL	ug/L	500
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	500
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	500
127-18-4	Tetrachloroethene	BRL	ug/L	500
591-78-6	2-Hexanone	BRL	ug/L	5,000
124-48-1	Dibromochloromethane	BRL	ug/L	500
108-90-7	Chlorobenzene	BRL	ug/L	500
100-41-4	Ethylbenzene	BRL	ug/L	500
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	500
95-47-6	ortho-Xylene	BRL	ug/L	500
100-42-5	Styrene	BRL	ug/L	500
75-25-2	Bromoform	BRL	ug/L	500
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	500

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	89 %	86 - 118 %
1,2-Dichloroethane-d ₄	90 %	80 - 120 %
Toluene-d ₈	91 %	88 - 110 %
4-Bromofluorobenzene	93 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Laboratory ID:

60611-04

Field ID: GEO-SB-100C
Project: 60 Olympia/2491
Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: HCl / Cool

Matrix:

 60 Olympia/2491
 QC Batch ID:
 VM5-2519-W

 GeoInsight, Inc.
 Sampled:
 04-28-03

 40 mL VOA Vial
 Received:
 04-30-03

 HCI / Cool
 Analyzed:
 05-05-03

 Aqueous
 Dilution Factor:
 5,000

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/L	2,500
75-01-4	Vinyl Chloride	BRL	ug/L	2,500
74-83-9	Bromomethane	BRL	ug/L	2,500
75-00-3	Chloroethane	BRL	ug/L	2,500
75-35-4	1,1-Dichloroethene	BRL	ug/L	2,500
67-64-1	Acetone	BRL	ug/L	50,000
75-15-0	Carbon Disulfide	BRL	ug/L	25,000
75-09-2	Methylene Chloride	BRL	ug/L	13,000
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	2,500
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	2,500
75-34-3	1,1-Dichloroethane	BRL	ug/L	2,500
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	2,500
78-93-3	2-Butanone (MEK)	BRL	ug/L	25,000
67-66-3	Chloroform	BRL	ug/L	2,500
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	2,500
56-23-5	Carbon Tetrachloride	BRL	ug/L	2,500
71-43-2	Benzene	BRL	ug/L	2,500
107-06-2	1,2-Dichloroethane	BRL	ug/L	2,500
79-01-6	Trichloroethene	140,000	ug/L	2,500
78-87-5	1,2-Dichloropropane	BRL	ug/L	2,500
75-27-4	Bromodichloromethane	BRL	ug/L	2,500
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	2,500
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	25,000
108-88-3	Toluene	BRL	ug/L	2,500
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	2,500
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	2,500
127-18-4	Tetrachloroethene	BRL	ug/L	2,500
591-78-6	2-Hexanone	BRL	ug/L	25,000
124-48-1	Dibromochloromethane	BRL	ug/L	2,500
108-90-7	Chlorobenzene	BRL	ug/L	2,500
100-41-4	Ethylbenzene	BRL	ug/L	2,500
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	2,500
95-47-6	ortho- Xylene	BRL	ug/L	2,500
100-42-5	Styrene	BRL	ug/L	2,500
75-25-2	Bromoform	BRL	ug/L	2,500
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	2,500

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	107 %	86 - 118 %
1,2-Dichloroethane-d ₄	105 %	80 - 120 %
Toluene-d ₈	108 %	88 - 110 %
4-Bromofluorobenzene	113 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis

performed utilizing 25mL sample purge volume.

Report Notations: BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

GEO-SB-100D

Project: Client:

Matrix:

60 Olympia/2491 GeoInsight, Inc.

Container: Preservation: 40 mL VOA Vial HCl / Cool Aqueous Laboratory ID: QC Batch ID:

60611-05

Sampled:

VM5-2519-W

Received:

04-28-03 04-30-03 05-05-03

Analyzed:

Dilution Factor: 1,000

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/L	500
75-01-4	Vinyl Chloride	BRL	ug/L	500
74-83-9	Bromomethane	BRL	ug/L	500
75-00-3	Chloroethane	BRL	ug/L	500
75-35-4	1,1-Dichloroethene	BRL	ug/L	500
67-64-1	Acetone	BRL	ug/L	10,000
75-15-0	Carbon Disulfide	BRL	ug/L	5,000
75-09-2	Methylene Chloride	BRL	ug/L	2,500
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	500
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	500
75-34-3	1,1-Dichloroethane	BRL	ug/L	500
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	500
78-93-3	2-Butanone (MEK)	BRL	ug/L	5,000
67-66-3	Chloroform	BRL	ug/L	500
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	500
56-23-5	Carbon Tetrachloride	BRL	ug/L	500
71-43-2	Benzene	BRL	ug/L	500
107-06-2	1,2-Dichloroethane	BRL	ug/L	500
79-01-6	Trichloroethene	21,000	ug/L	500
78-87-5	1,2-Dichloropropane	BRL	ug/L	500
75-27-4	Bromodichloromethane	BRL	ug/L	500
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/L	500
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5,000
108-88-3	Toluene	BRL	ug/L	500
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	500
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	500
127-18-4	Tetrachloroethene	BRL	ug/L	500
591-78-6	2-Hexanone	BRL	ug/L	5,000
124-48-1	Dibromochloromethane	BRL	ug/L	500
108-90-7	Chlorobenzene	BRL	ug/L	500
100-41-4	Ethylbenzene	BRL	ug/L	500
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	500
95-47-6	ortho-Xylene	BRL	ug/L	500
100-42-5	Styrene	BRL	ug/L	500
75-25-2	Bromoform	BRL	ug/L	500
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	500

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	88 %	86 - 118 %
1,2-Dichloroethane-d ₄	86 %	80 - 120 %
Toluene-d ₈	90 %	88 - 110 %
4-Bromofluorobenzene	93 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

RL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID: GEO-SB-103D Laboratory ID: 60611-06 Project: 60 Olympia/2491 QC Batch ID: VM4-2592-W Client: Geolnsight, Inc. Sampled: 04-25-03 Container: 40 mL VOA Vial Received: 04-30-03 Preservation: HCI / Cool Analyzed: 05-08-03

Matrix: Aqueous Dilution Factor: 1

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	5	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho- Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	99 %	86 - 118 %
1,2-Dichloroethane-d ₄	98 %	80 - 120 %
Toluene-d ₈	100 %	88 - 110 %
4-Bromofluorobenzene	115 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



60611-07 Laboratory ID: Field ID: GEO-SB-103E VM5-2521-W 60 Olympia/2491 QC Batch ID: Project: Sampled: 04-25-03 Geolnsight, Inc. Client: 40 mL VOA Vial Received: 04-30-03 Container: Preservation: HCI / Cool Analyzed: 05-06-03

Matrix: Aqueous Dilution Factor: 1

CAS Number	Analyte	Concentration	Units	Reporting Limit
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	88 %	86 - 118 %
1,2-Dichloroethane-d ₄	89 %	80 - 120 %
Toluene-d ₈	90 %	88 - 110 %
4-Bromofluorobenzene	95 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID: GEO-SB-102D Laboratory ID: 60611-08 60 Olympia/2491 QC Batch ID: Project: VM5-2521-W Geolnsight, Inc. Client: Sampled: 04-25-03 40 mL VOA Vial Received: 04-30-03 Container: Preservation: HCI / Cool Analyzed: 05-06-03 Dilution Factor: Matrix: Aqueous 20,000

CAS Number	Analyte	Concentration	Units	Reporting Limit
74-87-3	Chloromethane	BRL	ug/L	10,000
75-01-4	Vinyl Chloride	BRL	ug/L	10,000
74-83-9	Bromomethane	BRL	ug/L	10,000
75-00-3	Chloroethane	BRL	ug/L	10,000
75-35-4	1,1-Dichloroethene	BRL	ug/L	10,000
67-64-1	Acetone	BRL	ug/L	200,000
75-15-0	Carbon Disulfide	BRL	ug/L	100,000
75-09-2	Methylene Chloride	BRL	ug/L	50,000
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	10,000
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	10,000
75-34-3	1,1-Dichloroethane	BRL	ug/L	10,000
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	10,000
78-93-3	2-Butanone (MEK)	BRL	ug/L	100,000
67-66-3	Chloroform	BRL	ug/L	10,000
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	10,000
56-23-5	Carbon Tetrachloride	BRL	ug/L	10,000
71-43-2	Benzene	BRL	ug/L	10,000
107-06-2	1,2-Dichloroethane	BRL	ug/L	10,000
79-01-6	Trichloroethene	670,000	ug/L	10,000
78-87-5	1,2-Dichloropropane	BRL	ug/L	10,000
75-27-4	Bromodichloromethane	BRL	ug/L	10,000
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/L	10,000
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	100,000
108-88-3	Toluene	BRL	ug/L	10,000
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	10,000
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	10,000
127-18-4	Tetrachloroethene	BRL	ug/L	10,000
591-78-6	2-Hexanone	BRL	ug/L	100,000
124-48-1	Dibromochloromethane	BRL	ug/L	10,000
108-90-7	Chlorobenzene	BRL	ug/L	10,000
100-41-4	Ethylbenzene	BRL	ug/L	10,000
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	10,000
95-47-6	ortho-Xylene	BRL	ug/L	10,000
100-42-5	Styrene	BRL	ug/L	10,000
75-25-2	Bromoform	BRL	ug/L	10,000
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	10,000

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	93 %	86 - 118 %
1,2-Dichloroethane-d₄	92 %	80 - 120 %
Toluene-d ₈	96 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations: BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID: GEO-SB-102E
Project: 60 Olympia/2491
Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: HCI / Cool

Aqueous

Matrix:

Laboratory ID: 60611-09
QC Batch ID: VM5-2520-W
Sampled: 04-25-03
Received: 04-30-03
Analyzed: 05-06-03
Dilution Factor: 500

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/L	250
75-01-4	Vinyl Chloride	BRL	ug/L	250
74-83-9	Bromomethane	BRL	ug/L	250
75-00-3	Chloroethane	BRL	ug/L	250
75-35-4	1,1-Dichloroethene	BRL	ug/L	250
67-64-1	Acetone	BRL	ug/L	5,000
75-15-0	Carbon Disulfide	BRL	ug/L	2,500
75-09-2	Methylene Chloride	BRL	ug/L	1,300
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	250
1634-04-4	Methyl tert-butyl Ether (MTBE) 0	BRL	ug/L	250
75-34-3	1,1-Dichloroethane	BRL	ug/L	250
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	250
78-93-3	2-Butanone (MEK)	BRL	ug/L	2,500
67-66-3	Chloroform	BRL	ug/L	250
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	250
56-23-5	Carbon Tetrachloride	BRL	ug/L	250
71-43-2	Benzene	BRL	ug/L	250
107-06-2	1,2-Dichloroethane	BRL	ug/L	250
79-01-6	Trichloroethene	15,000	ug/L	250
78-87-5	1,2-Dichloropropane	BRL	ug/L	250
75-27-4	Bromodichloromethane	BRL	ug/L	250
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/L	250
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	2,500
108-88-3	Toluene	BRL	ug/L	250
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	250
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	250
127-18-4	Tetrachloroethene	BRL	ug/L	250
591-78-6	2-Hexanone	BRL	ug/L	2,500
124-48-1	Dibromochloromethane	BRL	ug/L	250
108-90-7	Chlorobenzene	BRL	ug/L	250
100-41-4	Ethylbenzene	BRL	ug/L	250
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	250
95-47-6	ortho- Xylene	BRL	ug/L	250
100-42-5	Styrene	BRL	ug/L	250
75-25-2	Bromoform	BRL	ug/L	250
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	250

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	86 %	86 - 118 %	
1,2-Dichloroethane-d ₄	90 %	80 - 120 %	
Toluene-d ₈	88 %	88 - 110 %	
4-Bromofluorobenzene	95 %	86 - 115 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



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EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-101A

Project: Client:

60 Olympia/2491 Geolnsight, Inc.

Container: Preservation:

% Moisture:

40 mL VOA Vial Methanol / Cool

Matrix: Soil Laboratory ID:

60611-10

QC Batch ID: Sampled:

VM1-1326-E

Received:

04-28-03 04-30-03

Analyzed:

05-03-03

Dilution Factor:

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/Kg	620
75-01-4	Vinyl Chloride	BRL	ug/Kg	620
74-83-9	Bromomethane	BRL	ug/Kg	620
75-00-3	Chloroethane	BRL	ug/Kg	620
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	310
67-64-1	Acetone	BRL	ug/Kg	3,100
75-15-0	Carbon Disulfide	BRL	ug/Kg	3,100
75-09-2	Methylene Chloride	BRL	ug/Kg	1,200
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	310
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	310
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	310
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	310
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	3,100
67-66-3	Chloroform	BRL	ug/Kg	310
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	310
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	310
71-43-2	Benzene	BRL	ug/Kg	310
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	310
79-01-6	Trichloroethene	740	ug/Kg	310
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	310
75-27-4	Bromodichloromethane	BRL	ug/Kg	310
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	310
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	3,100
108-88-3	Toluene	BRL	ug/Kg	310
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	310
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	310
127-18-4	Tetrachloroethene	BRL	ug/Kg	310
591-78-6	2-Hexanone	BRL	ug/Kg	3,100
124-48-1	Dibromochloromethane	BRL	ug/Kg	310
108-90-7	Chlorobenzene	BRL	ug/Kg	310
100-41-4	Ethylbenzene	BRL	ug/Kg	310
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	310
95-47-6	ortho-Xylene	BRL	ug/Kg	310
100-42-5	Styrene	BRL	ug/Kg	310
75-25-2	Bromoform	BRL	ug/Kg	310
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	310
OC:	Surrogate Compounds	Recovery	0	C Limits

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	110 %	80 - 120 %
1,2-Dichloroethane-d ₄	110 %	80 - 120 %
Toluene-d ₈	84 %	81 - 117 %
4-Bromofluorobenzene	92 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Field ID: GEO-SB-101B
Project: 60 Olympia/2491
Client: GeoInsight, Inc.
Container: 40 mL VOA Vial

Preservation: Methanol / Cool

Matrix: Soil % Moisture: 23

Laboratory ID: 60611-11

QC Batch ID: VM1-1326-E

Sampled: 04-28-03

Received: **04-30-03** Analyzed: **05-03-03**

Dilution Factor: 2

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/Kg	1,400
75-01-4	Vinyl Chloride	BRL	ug/Kg	1,400
74-83-9	Bromomethane	BRL	ug/Kg	1,400
75-00-3	Chloroethane	BRL	ug/Kg	1,400
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	680
67-64-1	Acetone	BRL	ug/Kg	6,800
75-15-0	Carbon Disulfide	BRL	ug/Kg	6,800
75-09-2	Methylene Chloride	BRL	ug/Kg	2,700
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/Kg	680
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	680
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	680
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	680
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	6,800
67-66-3	Chloroform	BRL	ug/Kg	680
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	680
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	680
71-43-2	Benzene	BRL	ug/Kg	680
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	680
79-01-6	Trichloroethene	8,800	ug/Kg	680
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	680
75-27-4	Bromodichloromethane	BRL	ug/Kg	680
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	680
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	6,800
108-88-3	Toluene	BRL	ug/Kg	680
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	680
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	680
127-18-4	Tetrachloroethene	BRL	ug/Kg	680
591-78-6	2-Hexanone	BRL	ug/Kg	6,800
124-48-1	Dibromochloromethane	BRL	ug/Kg	680
108-90-7	Chlorobenzene	BRL	ug/Kg	680
100-41-4	Ethylbenzene	BRL	ug/Kg	680
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	680
95-47-6	ortho- Xylene	BRL	ug/Kg	680
100-42-5	Styrene	BRL	ug/Kg	680
75-25-2	Bromoform	BRL	ug/Kg	680
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	680
OC	Surrogate Compounds	Recovery		C Limits
QC surrogate Compounds		100.0/		120.00

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	108 %	80 - 120 %
1,2-Dichloroethane-d ₄	109 %	80 - 120 %
Toluene-d ₈	88 %	81 - 117 %
4-Bromofluorobenzene	108 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Field ID:

GEO-SB-101C

Project: Client:

60 Olympia/2491

Container:

Geolnsight, Inc. 40 mL VOA Vial

Preservation:

Methanol / Cool

Laboratory ID: QC Batch ID:

60611-12

Sampled:

VM1-1326-E 04-28-03

Received:

04-30-03

Analyzed:

05-03-03

Dilution Factor: 2

Soil Matrix:

% Moisture: 24

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/Kg	1,100
75-01-4	Vinyl Chloride	BRL	ug/Kg	1,100
74-83-9	Bromomethane	BRL	ug/Kg	1,100
75-00-3	Chloroethane	BRL	ug/Kg	1,100
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	560
67-64-1	Acetone	BRL	ug/Kg	5,600
75-15-0	Carbon Disulfide	BRL	ug/Kg	5,600
75-09-2	Methylene Chloride	BRL	ug/Kg	2,300
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	560
1634-04-4	Methyl tert-butyl Ether (MTBE) 0	BRL	ug/Kg	560
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	560
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	560
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	5,600
67-66-3	Chloroform	BRL	ug/Kg	560
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	560
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	560
71-43-2	Benzene	BRL	ug/Kg	560
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	560
79-01-6	Trichloroethene	7,700	ug/Kg	560
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	560
75-27-4	Bromodichloromethane	BRL	ug/Kg	560
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	560
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	5,600
108-88-3	Toluene	BRL	ug/Kg	560
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	560
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	560
127-18-4	Tetrachloroethene	BRL	ug/Kg	560
591-78-6	2-Hexanone	BRL	ug/Kg	5,600
124-48-1	Dibromochloromethane	BRL	ug/Kg	560
108-90-7	Chlorobenzene	BRL	ug/Kg	560
100-41-4	Ethylbenzene	BRL	ug/Kg	560
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	560
95-47-6	ortho-Xylene	BRL	ug/Kg	560
100-42-5	Styrene	BRL	ug/Kg	560
75-25-2	Bromoform	BRL	ug/Kg	560
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	560

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	107 %	80 - 120 %
1,2-Dichloroethane-d ₄	110 %	80 - 120 %
Toluene-d ₈	82 %	81 - 117 %
4-Bromofluorobenzene	109 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Field ID: GEO-SB-100A Project: 60 Olympia/2491 Client: Geolnsight, Inc. 40 mL VOA Vial Container: Preservation: Methanol / Cool

Soil Matrix: 20 % Moisture:

Laboratory ID: 60611-13 OC Batch ID: VM1-1326-E Sampled: 04-28-03 Received: 04-30-03

05-03-03 Analyzed:

Dilution Factor: 2

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/Kg	1,200
75-01-4	Vinyl Chloride	BRL	ug/Kg	1,200
74-83-9	Bromomethane	BRL	ug/Kg	1,200
75-00-3	Chloroethane	BRL	ug/Kg	1,200
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	620
67-64-1	Acetone	BRL	ug/Kg	6,200
75-15-0	Carbon Disulfide	BRL	ug/Kg	6,200
75-09-2	Methylene Chloride	BRL	ug/Kg	2,500
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	620
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	620
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	620
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	620
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	6,200
67-66-3	Chloroform	BRL	ug/Kg	620
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	620
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	620
71-43-2	Benzene	BRL	ug/Kg	620
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	620
79-01-6	Trichloroethene	14,000	ug/Kg	620
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	620
75-27-4	Bromodichloromethane	BRL	ug/Kg	620
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	620
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	6,200
108-88-3	Toluene	BRL	ug/Kg	620
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	620
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	620
127-18-4	Tetrachloroethene	BRL	ug/Kg	620
591-78-6	2-Hexanone	BRL	ug/Kg	6,200
124-48-1	Dibromochloromethane	BRL	ug/Kg	620
108-90-7	Chlorobenzene	BRL	ug/Kg	620
100-41-4	Ethylbenzene	BRL	ug/Kg	620
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	620
95-47-6	ortho-Xylene	BRL	ug/Kg	620
100-42-5	Styrene	BRL	ug/Kg	620
75-25-2	Bromoform	BRL	ug/Kg	620
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	620
QC :	Surrogate Compounds	Recovery	Q	CLimits

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	108 %	80 - 120 %
1,2-Dichloroethane-d ₄	105 %	80 - 120 %
Toluene-d ₈	84 %	81 - 117 %
4-Bromofluorobenzene	104 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Field ID: GEO-SB-100B
Project: 60 Olympia/2491
Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: Methanol / Cool

Laboratory ID: 60611-14
QC Batch ID: VM1-1326-E
Sampled: 04-28-03
Received: 04-30-03
Analyzed: 05-03-03
Dilution Factor: 4

Matrix: Soil

% Moisture: 24

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/Kg	2,600
75-01-4	Vinyl Chloride	BRL	ug/Kg	2,600
74-83-9	Bromomethane	BRL	ug/Kg	2,600
75-00-3	Chloroethane	BRL	ug/Kg	2,600
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	1,300
67-64-1	Acetone	BRL	ug/Kg	13,000
75-15-0	Carbon Disulfide	BRL	ug/Kg	13,000
75-09-2	Methylene Chloride	BRL	ug/Kg	5,200
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	1,300
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	1,300
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	1,300
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	1,300
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	13,000
67-66-3	Chloroform	BRL	ug/Kg	1,300
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	1,300
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	1,300
71-43-2	Benzene	BRL	ug/Kg	1,300
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	1,300
79-01-6	Trichloroethene	23,000	ug/Kg	1,300
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	1,300
75-27-4	Bromodichloromethane	BRL	ug/Kg	1,300
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	1,300
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	13,000
108-88-3	Toluene	BRL	ug/Kg	1,300
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	1,300
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	1,300
127-18-4	Tetrachloroethene	BRL	ug/Kg	1,300
591-78-6	2-Hexanone	BRL	ug/Kg	13,000
124-48-1	Dibromochloromethane	BRL	ug/Kg	1,300
108-90-7	Chlorobenzene	BRL	ug/Kg	1,300
100-41-4	Ethylbenzene	BRL	ug/Kg	1,300
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	1,300
95-47-6	ortho- Xylene	BRL	ug/Kg	1,300
100-42-5	Styrene	BRL	ug/Kg	1,300
75-25-2	Bromoform	BRL	ug/Kg	1,300
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	1,300

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	107 %	80 - 120 %
1,2-Dichloroethane-d ₄	105 %	80 - 120 %
Toluene-d ₈	103 %	81 - 117 %
4-Bromofluorobenzene	106 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



60611-15 Field ID: GEO-SB-103A Laboratory ID: 60 Olympia/2491 QC Batch ID: VM1-1325-S Project: Sampled: 04-25-03 Geolnsight, Inc. Client: 04-30-03 Received: 40 mL VOA Vial Container: NaHSO4 / Cool Analyzed: 05-02-03 Preservation:

Matrix: Soil Dilution Factor:

% Moisture: 10

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/Kg	18
75-01-4	Vinyl Chloride	BRL	ug/Kg	18
74-83-9	Bromomethane	BRL	ug/Kg	18
75-00-3	Chloroethane	BRL	ug/Kg	18
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	9
67-64-1	Acetone	BRL	ug/Kg	360
75-15-0	Carbon Disulfide	BRL	ug/Kg	91
75-09-2	Methylene Chloride	BRL	ug/Kg	91
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	9
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	9
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	9
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	9
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	91
67-66-3	Chloroform	BRL	ug/Kg	9
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	9
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	9
71-43-2	Benzene	BRL	ug/Kg	9
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	9
79-01-6	Trichloroethene	16	ug/Kg	9
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	9
75-27-4	Bromodichloromethane	BRL	ug/Kg	9
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	9
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	91
108-88-3	Toluene	BRL	ug/Kg	9
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	9
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	9
127-18-4	Tetrachloroethene	BRL	ug/Kg	9
591-78-6	2-Hexanone	BRL	ug/Kg	91
124-48-1	Dibromochloromethane	BRL	ug/Kg	9
108-90-7	Chlorobenzene	BRL	ug/Kg	9
100-41-4	Ethylbenzene	BRL	ug/Kg	9
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	9
95-47-6	ortho-Xylene	BRL	ug/Kg	9
100-42-5	Styrene	BRL	ug/Kg	9
75-25-2	Bromoform	BRL	ug/Kg	9
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	9

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	110 %	80 - 120 %
1,2-Dichloroethane-d ₄	92 %	80 - 120 %
Toluene-d ₈	97 %	81 - 117 %
4-Bromofluorobenzene	106 %	74 - 121 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are

reported on a dry weight basis.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution, percent moisture and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-103B

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial NaHSO4 / Cool

Preservation: Matrix:

Soil

Laboratory ID: QC Batch ID:

60611-16

Sampled:

VM1-1325-S 04-25-03

Received: Analyzed: 04-30-03 05-02-03

Dilution Factor:

% Moisture:

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/Kg	20
75-01-4	Vinyl Chloride	BRL	ug/Kg	20
74-83-9	Bromomethane	BRL	ug/Kg	20
75-00-3	Chloroethane	BRL	ug/Kg	20
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	10
67-64-1	Acetone	BRL	ug/Kg	410
75-15-0	Carbon Disulfide	BRL	ug/Kg	100
75-09-2	Methylene Chloride	BRL	ug/Kg	100
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	10
1634-04-4	Methyl tert-butyl Ether (MTBE) 0	BRL	ug/Kg	10
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	10
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	10
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	100
67-66-3	Chloroform	BRL	ug/Kg	10
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	10
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	10
71-43-2	Benzene	BRL	ug/Kg	10
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	10
79-01-6	Trichloroethene	BRL	ug/Kg	10
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	10
75-27-4	Bromodichloromethane	BRL	ug/Kg	10
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	10
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	100
108-88-3	Toluene	BRL	ug/Kg	10
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	10
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	10
127-18-4	Tetrachloroethene	BRL	ug/Kg	10
591-78-6	2-Hexanone	BRL	ug/Kg	100
124-48-1	Dibromochloromethane	BRL	ug/Kg	10
108-90-7	Chlorobenzene	BRL	ug/Kg	10
100-41-4	Ethylbenzene	BRL	ug/Kg	10
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	10
95-47-6	ortho-Xylene	BRL	ug/Kg	10
100-42-5	Styrene	BRL	ug/Kg	10
75-25-2	Bromoform	BRL	ug/Kg	10
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	10

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	109 %	80 - 120 %
1,2-Dichloroethane-d ₄	108 %	80 - 120 %
Toluene-d ₈	84 %	81 - 117 %
4-Bromofluorobenzene	100 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-103C

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation: Matrix:

NaHSO4 / Cool Soil

Laboratory ID: QC Batch ID:

60611-17

Sampled:

VM1-1325-S 04-25-03

Received:

04-30-03 05-02-03

Analyzed:

Dilution Factor:

% Moisture:

CAS Number	Analyte	Concentration	Units	Reporting Limit
74-87-3	Chloromethane	BRL	ug/Kg	20
75-01-4	Vinyl Chloride	BRL	ug/Kg	20
74-83-9	Bromomethane	BRL	ug/Kg	20
75-00-3	Chloroethane	BRL	ug/Kg	20
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	10
67-64-1	Acetone	BRL	ug/Kg	390
75-15-0	Carbon Disulfide	BRL	ug/Kg	98
75-09-2	Methylene Chloride	BRL	ug/Kg	98
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	10
1634-04-4	Methyl tert-butyl Ether (MTBE) 0	BRL	ug/Kg	10
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	10
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	10
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	98
67-66-3	Chloroform	BRL	ug/Kg	10
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	10
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	10
71-43-2	Benzene	BRL	ug/Kg	10
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	10
79-01-6	Trichloroethene	BRL	ug/Kg	10
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	10
75-27-4	Bromodichloromethane	BRL	ug/Kg	10
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	10
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	98
108-88-3	Toluene	BRL	ug/Kg	10
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	10
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	10
127-18-4	Tetrachloroethene	BRL	ug/Kg	10
591-78-6	2-Hexanone	BRL	ug/Kg	98
124-48-1	Dibromochloromethane	BRL	ug/Kg	10
108-90-7	Chlorobenzene	BRL	ug/Kg	10
100-41-4	Ethylbenzene	BRL	ug/Kg	10
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	10
95-47-6	ortho-Xylene	BRL	ug/Kg	10
100-42-5	Styrene	BRL	ug/Kg	10
75-25-2	Bromoform	BRL	ug/Kg	10
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	10

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	109 %	80 - 120 %
1,2-Dichloroethane-d ₄	116 %	80 - 120 %
Toluene-d ₈	82 %	81 - 117 %
4-Bromofluorobenzene	105 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-102A

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation:

Methanol / Cool

Matrix:

Soil

Laboratory ID: QC Batch ID:

60611-18

Sampled:

VM1-1326-E 04-25-03

Received:

04-25-03

Analyzed: Dilution Factor:

05-03-03

% Moisture: 16

CAS Number	Analyte	Concentration	Units	Reporting Lin
74-87-3	Chloromethane	BRL	ug/Kg	520
75-01-4	Vinyl Chloride	BRL	ug/Kg	520
74-83-9	Bromomethane	BRL	ug/Kg	520
75-00-3	Chloroethane	BRL	ug/Kg	520
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	260
67-64-1	Acetone	BRL	ug/Kg	2,600
75-15-0	Carbon Disulfide	BRL	ug/Kg	2,600
75-09-2	Methylene Chloride	BRL	ug/Kg	1,000
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	260
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	260
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	260
156-59-2	cis- 1,2-Dichloroethene	BRL	ug/Kg	260
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	2,600
67-66-3	Chloroform	BRL	ug/Kg	260
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	260
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	260
71-43-2	Benzene	BRL	ug/Kg	260
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	260
79-01-6	Trichloroethene	760	ug/Kg	260
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	260
75-27-4	Bromodichloromethane	BRL	ug/Kg	260
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	260
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	2,600
108-88-3	Toluene	BRL	ug/Kg	260
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	260
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	260
127-18-4	Tetrachloroethene	BRL	ug/Kg	260
591-78-6	2-Hexanone	BRL	ug/Kg	2,600
124-48-1	Dibromochloromethane	BRL	ug/Kg	260
108-90-7	Chlorobenzene	BRL	ug/Kg	260
100-41-4	Ethylbenzene	BRL	ug/Kg	260
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	260
95-47-6	ortho-Xylene	BRL	ug/Kg	260
100-42-5	Styrene	BRL	ug/Kg	260
75-25-2	Bromoform	BRL	ug/Kg	260
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	260

QC Surrogate Compounds	Recovery	QC Limits		
Dibromofluoromethane	104 %	80 - 120 %		
1,2-Dichloroethane-d ₄	105 %	80 - 120 %		
Toluene-d ₈	100 %	81 - 117 %		
4-Bromofluorobenzene	99 %	74 - 121 %		

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-102B

Project:

60 Olympia/2491

Client:

Geolnsight, Inc.

Container: Preservation:

% Moisture:

40 mL VOA Vial Methanol / Cool

Matrix:

Soil

26

Laboratory ID: QC Batch ID:

60611-19 VM1-1329-E

Sampled:

04-25-03

Received:

04-30-03

Analyzed:

05-07-03

Dilution Factor:

10

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/Kg	9,600
75-01-4	Vinyl Chloride	BRL	ug/Kg	9,600
74-83-9	Bromomethane	BRL	ug/Kg	9,600
75-00-3	Chloroethane	BRL	ug/Kg	9,600
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	4,800
67-64-1	Acetone	BRL	ug/Kg	48,000
75-15-0	Carbon Disulfide	BRL	ug/Kg	48,000
75-09-2	Methylene Chloride	BRL	ug/Kg	19,000
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/Kg	4,800
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	4,800
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	4,800
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	4,800
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	48,000
67-66-3	Chloroform	BRL	ug/Kg	4,800
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	4,800
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	4,800
71-43-2	Benzene	BRL	ug/Kg	4,800
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	4,800
79-01-6	Trichloroethene	120,000	ug/Kg	4,800
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	4,800
75-27-4	Bromodichloromethane	BRL	ug/Kg	4,800
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	4,800
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	48,000
108-88-3	Toluene	BRL	ug/Kg	4,800
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/Kg	4,800
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	4,800
127-18-4	Tetrachloroethene	BRL	ug/Kg	4,800
591-78-6	2-Hexanone	BRL	ug/Kg	48,000
124-48-1	Dibromochloromethane	BRL	ug/Kg	4,800
108-90-7	Chlorobenzene	BRL	ug/Kg	4,800
100-41-4	Ethylbenzene	BRL	ug/Kg	4,800
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	4,800
95-47-6	ortho-Xylene	BRL	ug/Kg	4,800
100-42-5	Styrene	BRL	ug/Kg	4,800
75-25-2	Bromoform	BRL	ug/Kg	4,800
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	4,800

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	115 %	80 - 120 %	
1,2-Dichloroethane-d ₄	106 %	80 - 120 %	
Toluene-d ₈	83 %	81 - 117 %	
4-Bromofluorobenzene	98 %	74 - 121 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



GEO-SB-102C Field ID: Project: 60 Olympia/2491 Client: Geolnsight, Inc. 40 mL VOA Vial Container: Preservation: Methanol / Cool

Matrix: Soil

% Moisture: 26

Report Notations:

Laboratory ID: 60611-20 OC Batch ID: VM1-1326-E Sampled: 04-25-03 Received: 04-30-03

05-03-03

Analyzed: Dilution Factor:

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/Kg	2,800
75-01-4	Vinyl Chloride	BRL	ug/Kg	2,800
74-83-9	Bromomethane	BRL	ug/Kg	2,800
75-00-3	Chloroethane	BRL	ug/Kg	2,800
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	1,400
67-64-1	Acetone	BRL	ug/Kg	14,000
75-15-0	Carbon Disulfide	BRL	ug/Kg	14,000
75-09-2	Methylene Chloride	BRL	ug/Kg	5,500
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	1,400
1634-04-4	Methyl tert-butyl Ether (MTBE) o	BRL	ug/Kg	1,400
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	1,400
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	1,400
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	14,000
67-66-3	Chloroform	BRL	ug/Kg	1,400
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	1,400
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	1,400
71-43-2	Benzene	BRL	ug/Kg	1,400
107-06-2	1,2-Dichloroethane	BRL ug/Kg		1,400
79-01-6	Trichloroethene	13,000	ug/Kg	1,400
78-87-5	1,2-Dichloropropane	BRL		
75-27-4	Bromodichloromethane	BRL	ug/Kg	1,400
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	1,400
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	14,000
108-88-3	Toluene	BRL	ug/Kg	1,400
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	1,400
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	1,400
127-18-4	Tetrachloroethene	BRL	ug/Kg	1,400
591-78-6	2-Hexanone	BRL	ug/Kg	14,000
124-48-1	Dibromochloromethane	BRL	ug/Kg	1,400
108-90-7	Chlorobenzene	BRL	ug/Kg	1,400
100-41-4	Ethylbenzene	BRL	ug/Kg	1,400
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	1,400
95-47-6	ortho-Xylene	BRL	ug/Kg	1,400
100-42-5	Styrene	BRL	ug/Kg	1,400
75-25-2	Bromoform	BRL	ug/Kg	1,400
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	1,400
QC:	Surrogate Compounds	Recovery	Q	C Limits

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	108 %	80 - 120 %	
1,2-Dichloroethane-d ₄	107 %	80 - 120 %	
Toluene-d ₈	82 %	81 - 117 %	
4-Bromofluorobenzene	107 %	74 - 121 %	

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list Method Reference:

as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest

concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

EPA Method 8260B TCL Volatile Organics by GC/MS

Field ID:

GEO-SB-98

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation: Matrix: % Moisture:

Methanol / Cool

Soil 16

Laboratory ID:

60611-21 VM1-1328-E

QC Batch ID: Sampled:

04-28-03

Received: Analyzed: 04-30-03 05-06-03

Dilution Factor: 1

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/Kg	770
75-01-4	Vinyl Chloride	BRL	ug/Kg	770
74-83-9	Bromomethane	BRL	ug/Kg	770
75-00-3	Chloroethane	BRL	ug/Kg	770
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	380
67-64-1	Acetone	BRL	ug/Kg	3,800
75-15-0	Carbon Disulfide	BRL	ug/Kg	3,800
75-09-2	Methylene Chloride	BRL	ug/Kg	1,500
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	380
1634-04-4	Methyl tert- butyl Ether (MTBE) 0	BRL	ug/Kg	380
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	380
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	380
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	3,800
67-66-3	Chloroform	BRL	ug/Kg	380
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	380
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	380
71-43-2	Benzene	BRL	ug/Kg	380
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	380
79-01-6	Trichloroethene	BRL	ug/Kg	380
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	380
75-27-4	Bromodichloromethane	BRL	ug/Kg	380
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/Kg	380
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	3,800
108-88-3	Toluene	BRL	ug/Kg	380
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/Kg	380
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	380
127-18-4	Tetrachloroethene	BRL	ug/Kg	380
591-78-6	2-Hexanone	BRL	ug/Kg	3,800
124-48-1	Dibromochloromethane	BRL	ug/Kg	380
108-90-7	Chlorobenzene	BRL	ug/Kg	380
100-41-4	Ethylbenzene	BRL	ug/Kg	380
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	380
95-47-6	ortho-Xylene	BRL	ug/Kg	380
100-42-5	Styrene	BRL	ug/Kg	380
75-25-2	Bromoform	BRL	ug/Kg	380
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	380

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	108 %	80 - 120 %	
1,2-Dichloroethane-d ₄	116 %	80 - 120 %	
Toluene-d ₈	85 %	81 - 117 %	
4-Bromofluorobenzene	104 %	74 - 121 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis. Analysis performed utilizing methanol extraction technique.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Inorganic Chemistry

Field ID: Project:

GEO-SB-101A

60 Olympia/2491

Client:

Geolnsight, Inc.

Matrix:

Soil

Received:

04-30-03

Lab ID:

60611-22

Sampled: 04-28-03 09:50

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	1,100	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA

Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

(1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest

value that can be reliably quantified under routine laboratory operating conditions.



Inorganic Chemistry

 Field ID:
 GEO-SB-101B
 Matrix:
 Soil

 Project:
 60 Olympia/2491
 Received:
 04-30-03

Client: Geolnsight, Inc.

Lab ID: 60611-23 Sampled: 04-28-03 10:10 Container: 250 mL Glass Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	660	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983),

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA

Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

(1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations: BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest

value that can be reliably quantified under routine laboratory operating conditions.



Inorganic Chemistry

Field ID: GEO-SB-101C
Project: 60 Olympia/2491
Client: GeoInsight, Inc.

Matrix: Soil Received: 04-30-03

Lab ID: 60611-24 Sampled: 04-28-03 10:45 Container: 250 mL Glass Preservation: Cool

Analyte Result Units Reporting Limit Analyzed QC Batch Method

Organic Carbon, Total BRL mg/Kg 560 05-05-03 TOC-0199-S EPA 9060 Mod

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983),

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA

Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

(1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations: BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest

value that can be reliably quantified under routine laboratory operating conditions.



Field ID: GEO-SB-100A

Project: 60 Olympia/2491 Client: GeoInsight, Inc. Matrix:

Soil

Received: (

04-30-03

Lab ID: 60611-25 Sampled: 04-28-03 13:15 Container: 250 mL Glass Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	610	mg/Kg	530	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983),

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA

Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

(1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations: BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest

value that can be reliably quantified under routine laboratory operating conditions.



Field ID: Project:

GEO-SB-100B

60 Olympia/2491

Geolnsight, Inc.

Matrix:

Soil

Received:

04-30-03

Lab ID:

Client:

60611-26

Sampled: 04-28-03 13:30

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	560	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983),

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA,

EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

(1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Field ID:

GEO-SB-103B

Matrix:

Soil

Project:

60 Olympia/2491

Received:

04-30-03

Client:

Geolnsight, Inc.

Lab ID: 60611-27

Sampled: 04-25-03 11:30

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	490	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Field ID: Project: GEO-SB-103C 60 Olympia/2491 Matrix:

Soil

Client:

Geolnsight, Inc.

Received:

04-30-03

Lab ID:

60611-28

Sampled: 04-25-03 11:53

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	510	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Field ID: Project: Client: GEO-SB-102A 60 Olympia/2491 GeoInsight, Inc. Matrix:

Soil

Received:

04-30-03

Lab ID:

60611-29

Sampled: 04-25-03 13:58

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	500	05-05-03	TOC-0199-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Field ID: Project:

GEO-SB-102B 60 Olympia/2491 Matrix:

Soil

Client:

Geolnsight, Inc.

Received:

04-30-03

Lab ID:

60611-32

Sampled: 04-28-03 14:10 Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	BRL	mg/Kg	600	05-06-03	TOC-0200-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Field ID: GEO-SB-102C Project:

60 Olympia/2491

Matrix:

Soil

Client:

Geolnsight, Inc.

Received:

04-30-03

Lab ID:

60611-31

Sampled: 04-25-03 14:23

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	640	mg/Kg	620	05-06-03	TOC-0200-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA, EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Field ID:

GEO-SB-98

Project: Client:

60 Olympia/2491

GeoInsight, Inc.

Matrix:

Soil

Received:

04-30-03

Lab ID:

60611-32 Sampled: 04-28-03 15:50

Container: 250 mL Glass

Preservation: Cool

Analyte	Result	Units	Reporting Limit	Analyzed	QC Batch	Method
Organic Carbon, Total	2,200	mg/Kg	520	05-06-03	TOC-0200-S	EPA 9060 Mod

Method References:

Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983),

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA,

EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA

Eighteenth Edition (1992), Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

(1996), and Agriculture Handbook 60, U.S. Department of Agriculture. Results are reported

on a dry weight basis.

Report Notations:

BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest value that can be reliably quantified under routine laboratory operating conditions.



Project Narrative

Project: Client: 60 Olympia/2491 Geolnsight, Inc.

Lab ID:

60611

Received:

04-30-03 18:30

A. Documentation and Client Communication

The following documentation discrepancies, and client changes or amendments were noted for this project:

1. No discrepancies, changes, or amendments were noted.

B. Method Non-Conformances

The following method non-conformances were noted for this project:

1. No method non-conformances were noted.

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рате	TIME	SAMPLE IDENTIFICATION	GROUNDWATER DRINKING WATER	WASI EWALEH SOIL OTHER SOLID DILYOPGANIC LIQUID	COMPOSITE	KUMBER KOML VOA Vial SOML/2 oz Glass	250mL/4 or Anther Glass 250mL/8 oz Glass	5U32 oz Amber Glass 250mL/8 oz Plantic	500mL/16 or Plastic 1L/32 oz Plastic	120mL Starte	- Feb.	NaOH	Sodium Bisuffatu CE	res Wo	LABORATORY NUMBER (Lab Use Only)	RCRA/21E	EQ2508 TCL.ANTRE	☐ 80218 Aromatics C1 60218 Halocarbons ☐ 80218	C 8270C C 8270C PAHs only	3081A Perticides 3 6082 PCBs	□ 8151A Harbizides	C) 8011 EDB/08CP C) 8 RCRA C) 5 RCRA C) MA Llet Metals	J 23 TAL Specify:	TPH-IR	Disease Range Organica DCT ETPH	MA DEP EPH what tan Hydrocarbon Progerpr	DIPH by GC/FID (8100 I D Gasoline Renge Organi JAA DEP VPH wing ter	TCLP CI SPLP CI 8 MA	O MA Beats Disposal Cris O Mirate (O Minita (O C	D Disposited Phosphorus D Ammonia (3 110) (3 1	COP OF TOC	O Cyanida, Total Ci Cya	Total Colliform □ Fee	7
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ANALYTICAL	Telephone (ay, MA 02532 (508) 759-4441 dwateranalytica	• FAX (508)	759-4475			RK O		DDY REC	OHD														ľ	No	072	2657	
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SAMPLE IDENTIFICATION	GROUNDWATER DRINKING WATER WASTEWATER SOIL	OTHER SOLID OILUPRGANIC LIQUID COMPOSITE	GRAB NUMBER 40mL VOA Viai 60mL/2 oz Glass	250mL/8 oz Glass 500mL/18 oz Glass 1U/3 oz Amber Glass 250mL/8 oz Plasic S00mL/8 oz Plasic	1USE or Plastic 120mL Sterile HCI	HNO, H,SO,	NaOH Methanol Sodium Bisultate	A YES	LABORA NUME (Lab Use	BER e Only)	RCRA/21E	C 82508	☐ 80218 Aromatics ☐ 90218 Halocarbons ☐ 90218	C) 8270C PAHs only	CI 8081A Pesticides	CI 8151A Herbicidas	CI BOTT EDBADBOP	O S NOW O S NO	O TPH-IR	CI Diesei Range Organio CI CT ETPH	CI MA DEP EPH whill tar CI Hydrocarbon Fingerpr	CITPH by GC/FID (8100	Ditary Disput Dism	C) MA Basic Disposal Crit	O Dissolved Phrsphoru	C) 08 & Gresse	CI 800 CI TOS CI TOS CI CI Cyanida, Total CI Cyal CI pit Ci Dissolved Chyq	C Total Collorm C Free
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Quality Assurance/Quality Control

A. Program Overview

Groundwater Analytical conducts an active Quality Assurance program to ensure the production of high quality, valid data. This program closely follows the guidance provided by *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, US EPA QAMS-005/80 (1980), and *Test Methods for Evaluating Solid Waste*, US EPA, SW-846, Update III (1996).

Quality Control protocols include written Standard Operating Procedures (SOPs) developed for each analytical method. SOPs are derived from US EPA methodologies and other established references. Standards are prepared from commercially obtained reference materials of certified purity, and documented for traceability.

Quality Assessment protocols for most organic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. All samples, standards, blanks, laboratory control samples, matrix spikes and sample duplicates are spiked with internal standards and surrogate compounds. All instrument sequences begin with an initial calibration verification standard and a blank; and excepting GC/MS sequences, all sequences close with a continuing calibration standard. GC/MS systems are tuned to appropriate ion abundance criteria daily, or for each 12 hour operating period, whichever is more frequent.

Quality Assessment protocols for most inorganic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. Standard curves are derived from one reagent blank and four concentration levels. Curve validity is verified by standard recoveries within plus or minus ten percent of the curve.

B. Definitions

Batches are used as the basic unit for Quality Assessment. A Batch is defined as twenty or fewer samples of the same matrix which are prepared together for the same analysis, using the same lots of reagents and the same techniques or manipulations, all within the same continuum of time, up to but not exceeding 24 hours.

Laboratory Control Samples are used to assess the accuracy of the analytical method. A Laboratory Control Sample consists of reagent water or sodium sulfate spiked with a group of target analytes representative of the method analytes. Accuracy is defined as the degree of agreement of the measured value with the true or expected value. Perent Recoveries for the Laboratory Control Samples are calculated to assess accuracy.

Method Blanks are used to assess the level of contamination present in the analytical system. Method Blanks consist of reagent water or an aliquot of sodium sulfate. Method Blanks are taken through all the appropriate steps of an analytical method. Sample data reported is not corrected for blank contamination.

Surrogate Compounds are used to assess the effectiveness of an analytical method in dealing with each sample matrix. Surrogate Compounds are organic compounds which are similar to the target analytes of interest in chemical behavior, but which are not normally found in environmental samples. Percent Recoveries are calculated for each Surrogate Compound.



Category: EPA Method 8260B QC Batch ID: VM5-2519-WL

Matrix: Aqueous Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	10	8	82 %	70 - 130 %
71-43-2	Benzene	10	9	87 %	70 - 130 %
79-01-6	Trichloroethene	10	9	92 %	70 - 130 %
108-88-3	Toluene	10	9	90 %	70 - 130 %
108-90-7	Chlorobenzene	10	9	88 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	98 %	86 - 118 %
1,2-Dichloroethane-d ₄	102 %	80 - 120 %
Toluene-d ₈	100 %	88 - 110 %
4-Bromofluorobenzene	100 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B
QC Batch ID: VM5-2519-WB
Matrix: Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Lin
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) [◊]	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	99 %	86 - 118 %
1,2-Dichloroethane-d ₄	100 %	80 - 120 %
Toluene-d ₈	100 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis

performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B QC Batch ID: VM5-2521-WL

Matrix: Aqueous Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	10	9	85 %	70 - 130 %
71-43-2	Benzene	10	9	86 %	70 - 130 %
79-01-6	Trichloroethene	10	9	89 %	70 - 130 %
108-88-3	Toluene	10	9	89 %	70 - 130 %
108-90-7	Chlorobenzene	10	9	93 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	87 %	86 - 118 %
1,2-Dichloroethane-d ₄	88 %	80 - 120 %
Toluene-d ₈	90 %	88 - 110 %
4-Bromofluorobenzene	92 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B
QC Batch ID: VM5-2521-WB
Matrix: Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) 0	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	0.5
95-47-6	ortho- Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	101 %	86 - 118 %
1,2-Dichloroethane-d ₄	105 %	80 - 120 %
Toluene-d ₈	104 %	88 - 110 %
4-Bromofluorobenzene	111 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis

performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B QC Batch ID: VM5-2520-WL

Matrix: Aqueous
Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	10	11	112 %	70 - 130 %
71-43-2	Benzene	10	11	108 %	70 - 130 %
79-01-6	Trichloroethene	10	11	114 %	70 - 130 %
108-88-3	Toluene	10	11	109 %	70 - 130 %
108-90-7	Chlorobenzene	10	11	107 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	100 %	86 - 118 %
1,2-Dichloroethane-d₄	104 %	80 - 120 %
Toluene-d ₈	103 %	88 - 110 %
4-Bromofluorobenzene	99 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B QC Batch ID: VM5-2520-WB Matrix: Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert- butyl Ether (MTBE) [◊]	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	102 %	86 - 118 %
1,2-Dichloroethane-d ₄	105 %	80 - 120 %
Toluene-d ₈	104 %	88 - 110 %
4-Bromofluorobenzene	106 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B

QC Batch ID: VM1-1326-EL

Matrix: Soil Units: ug/Kg

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	2,500	2,300	92 %	70 - 130 %
71-43-2	Benzene	2,500	2,400	94 %	70 - 130 %
79-01-6	Trichloroethene	2,500	2,500	99 %	70 - 130 %
108-88-3	Toluene	2,500	2,400	94 %	70 - 130 %
108-90-7	Chlorobenzene	2,500	2,200	86 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	110 %	80 - 120 %
1,2-Dichloroethane-d ₄	108 %	80 - 120 %
Toluene-d ₈	103 %	81 - 117 %
4-Bromofluorobenzene	100 %	74 - 121 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B QC Batch ID: VM1-1326-EB

Matrix: Soil

CAS Number	Analyte	Concentration	Units	Reporting Lim
74-87-3	Chloromethane	BRL	ug/Kg	500
75-01-4	Vinyl Chloride	BRL	ug/Kg	500
74-83-9	Bromomethane	BRL	ug/Kg	500
75-00-3	Chloroethane	BRL	ug/Kg	500
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	250
67-64-1	Acetone	BRL	ug/Kg	2,500
75-15-0	Carbon Disulfide	BRL	ug/Kg	2,500
75-09-2	Methylene Chloride	BRL	ug/Kg	1,000
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	250
1634-04-4	Methyl tert-butyl Ether (MTBE) 0	BRL	ug/Kg	250
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	250
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	250
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	2,500
67-66-3	Chloroform	BRL	ug/Kg	250
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	250
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	250
71-43-2	Benzene	BRL	ug/Kg	250
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	250
79-01-6	Trichloroethene	BRL	ug/Kg	250
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	250
75-27-4	Bromodichloromethane	BRL	ug/Kg	250
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	250
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	2,500
108-88-3	Toluene	BRL	ug/Kg	250
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	250
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	250
127-18-4	Tetrachloroethene	BRL	ug/Kg	250
591-78-6	2-Hexanone	BRL	ug/Kg	2,500
124-48-1	Dibromochloromethane	BRL	ug/Kg	250
108-90-7	Chlorobenzene	BRL	ug/Kg	250
100-41-4	Ethylbenzene	BRL	ug/Kg	250
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	250
95-47-6	ortho- Xylene	BRL	ug/Kg	250
100-42-5	Styrene	BRL	ug/Kg	250
75-25-2	Bromoform	BRL	ug/Kg	250
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	250

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	110 %	80 - 120 %
1,2-Dichloroethane-d ₄	107 %	80 - 120 %
Toluene-d ₈	102 %	81 - 117 %
4-Bromofluorobenzene	101 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B QC Batch ID: VM1-1325-SL

Matrix: Soil

Units: ug/Kg

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	50	50	100 %	70 - 130 %
71-43-2	Benzene	50	46	92 %	70 - 130 %
79-01-6	Trichloroethene	50	50	101 %	70 - 130 %
108-88-3	Toluene	50	45	90 %	70 - 130 %
108-90-7	Chlorobenzene	50	51	102 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	87 %	80 - 120 %
1,2-Dichloroethane-d ₄	100 %	80 - 120 %
Toluene-d ₈	85 %	81 - 117 %
4-Bromofluorobenzene	86 %	74 - 121 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B QC Batch ID: VM1-1325-SB

Matrix: Soil

CAS Number	Analyte	Concentration	Units	Reporting Limi	
74-87-3	Chloromethane	BRL	ug/Kg	10	
75-01-4	Vinyl Chloride	BRL	ug/Kg	10	
74-83-9	Bromomethane	BRL	ug/Kg	10	
75-00-3	Chloroethane	BRL	ug/Kg	10	
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	5	
67-64-1	Acetone	BRL	ug/Kg	200	
75-15-0	Carbon Disulfide	BRL	ug/Kg	50	
75-09-2	Methylene Chloride	BRL	ug/Kg	50	
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	5	
1634-04-4	Methyl tert-butyl Ether (MTBE) [♦]	BRL	ug/Kg	5	
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	5	
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	5	
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	50	
67-66-3	Chloroform	BRL	ug/Kg	5	
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	5	
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	5	
71-43-2	Benzene	BRL	ug/Kg	5	
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	5	
79-01-6	Trichloroethene	BRL	ug/Kg	5	
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	5	
75-27-4	Bromodichloromethane	BRL	ug/Kg	5	
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	5	
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	50	
108-88-3	Toluene	BRL	ug/Kg	5	
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	5	
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	5	
127-18-4	Tetrachloroethene	BRL	ug/Kg	5	
591-78-6	2-Hexanone	BRL	ug/Kg	50	
124-48-1	Dibromochloromethane	BRL	ug/Kg	5	
108-90-7	Chlorobenzene	BRL	ug/Kg	5	
100-41-4	Ethylbenzene	BRL	ug/Kg	5	
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	5	
95-47-6	ortho-Xylene	BRL	ug/Kg	5	
100-42-5	Styrene	BRL	ug/Kg	5	
75-25-2	Bromoform	BRL	ug/Kg	5	
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	5	

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	110 %	80 - 120 %
1,2-Dichloroethane-d ₄	84 %	80 - 120 %
Toluene-d ₈	84 %	81 - 117 %
4-Bromofluorobenzene	112 %	74 - 121 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis.

Report Notations: BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B QC Batch ID: VM4-2592-WL

Matrix: Aqueous
Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	10	10	97 %	70 - 130 %
71-43-2	Benzene	10	10	98 %	70 - 130 %
79-01-6	Trichloroethene	10	10	102 %	70 - 130 %
108-88-3	Toluene	10	10	97 %	70 - 130 %
108-90-7	Chlorobenzene	10	10	99 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	102 %	86 - 118 %	
1,2-Dichloroethane-d ₄	104 %	80 - 120 %	
Toluene-d ₈	110 %	88 - 110 %	
4-Bromofluorobenzene	113 %	86 - 115 %	

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B QC Batch ID: VM4-2592-WB

Matrix:	Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Limi
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	0.5
95-47-6	ortho- Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	98 %	86 - 118 %
1,2-Dichloroethane-d ₄	99 %	80 - 120 %
Toluene-d ₈	108 %	88 - 110 %
4-Bromofluorobenzene	115 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B QC Batch ID: VM1-1328-EL

Matrix: Soil
Units: ug/Kg

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	2,500	2,700	106 %	70 - 130 %
71-43-2	Benzene	2,500	2,600	102 %	70 - 130 %
79-01-6	Trichloroethene	2,500	2,800	114 %	70 - 130 %
108-88-3	Toluene	2,500	2,600	103 %	70 - 130 %
108-90-7	Chlorobenzene	2,500	2,800	112 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	102 %	80 - 120 %	
1,2-Dichloroethane-d ₄	103 %	80 - 120 %	
Toluene-d ₈	105 %	81 - 117 %	
4-Bromofluorobenzene	103 %	74 - 121 %	

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B QC Batch ID: VM1-1328-EB

Matrix: Soil

CAS Number	Analyte	Concentration	Units	Reporting Limi	
74-87-3	Chloromethane	BRL	ug/Kg	500	
75-01-4	Vinyl Chloride	BRL	ug/Kg	500	
74-83-9	Bromomethane	BRL	ug/Kg	500	
75-00-3	Chloroethane	BRL	ug/Kg	500	
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	250	
67-64-1	Acetone	BRL	ug/Kg	2,500	
75-15-0	Carbon Disulfide	BRL	ug/Kg	2,500	
75-09-2	Methylene Chloride	BRL	ug/Kg	1,000	
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	250	
1634-04-4	Methyl tert- butyl Ether (MTBE) [◊]	BRL	ug/Kg	250	
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	250	
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	250	
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	2,500	
67-66-3	Chloroform	BRL	ug/Kg	250	
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	250	
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	250	
71-43-2	Benzene	BRL	ug/Kg	250	
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	250	
79-01-6	Trichloroethene	BRL	ug/Kg	250	
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	250	
75-27-4	Bromodichloromethane	BRL	ug/Kg	250	
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	250	
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	2,500	
108-88-3	Toluene	BRL	ug/Kg	250	
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	250	
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	250	
127-18-4	Tetrachloroethene	BRL	ug/Kg	250	
591-78-6	2-Hexanone	BRL	ug/Kg	2,500	
124-48-1	Dibromochloromethane	BRL	ug/Kg	250	
108-90-7	Chlorobenzene	BRL	ug/Kg	250	
100-41-4	Ethylbenzene	BRL	ug/Kg	250	
08-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/Kg	250	
95-47-6	ortho-Xylene	BRL	ug/Kg	250	
100-42-5	Styrene	BRL	ug/Kg	250	
75-25-2	Bromoform	BRL	ug/Kg	250	
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	250	

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	108 %	80 - 120 %	
1,2-Dichloroethane-d ₄	111 %	80 - 120 %	
Toluene-d ₈	100 %	81 - 117 %	
4-Bromofluorobenzene	109 %	74 - 121 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: EPA Method 8260B

QC Batch ID: VM1-1329-EL

Matrix: Soil Units: ug/Kg

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	2,500	2,400	96 %	70 - 130 %
71-43-2	Benzene	2,500	2,300	93 %	70 - 130 %
79-01-6	Trichloroethene	2,500	2,500	98 %	70 - 130 %
108-88-3	Toluene	2,500	2,500	98 %	70 - 130 %
108-90-7	Chlorobenzene	2,500	2,700	107 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	102 %	80 - 120 %	
1,2-Dichloroethane-d ₄	96 %	80 - 120 %	
Toluene-d ₈	102 %	81 - 117 %	
4-Bromofluorobenzene	116 %	74 - 121 %	

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: EPA Method 8260B QC Batch ID: VM1-1329-EB

Matrix: Soil

CAS Number	Analyte	Concentration	Units	Reporting Limi	
74-87-3	Chloromethane	BRL	ug/Kg	500	
75-01-4	Vinyl Chloride	BRL	ug/Kg	500	
74-83-9	Bromomethane	BRL	ug/Kg	500	
75-00-3	Chloroethane	BRL	ug/Kg	500	
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	250	
67-64-1	Acetone	BRL	ug/Kg	2,500	
75-15-0	Carbon Disulfide	BRL	ug/Kg	2,500	
75-09-2	Methylene Chloride	BRL	ug/Kg	1,000	
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/Kg	250	
1634-04-4	Methyl tert-butyl Ether (MTBE) °	BRL	ug/Kg	250	
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	250	
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	250	
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	2,500	
67-66-3	Chloroform	BRL	ug/Kg	250	
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	250	
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	250	
71-43-2	Benzene	BRL	ug/Kg	250	
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	250	
79-01-6	Trichloroethene	BRL	ug/Kg	250	
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	250	
75-27-4	Bromodichloromethane	BRL	ug/Kg	250	
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	250	
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	2,500	
108-88-3	Toluene	BRL	ug/Kg	250	
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/Kg	250	
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	250	
127-18-4	Tetrachloroethene	BRL	ug/Kg	250	
591-78-6	2-Hexanone	BRL	ug/Kg	2,500	
124-48-1	Dibromochloromethane	BRL	ug/Kg	250	
108-90-7	Chlorobenzene	BRL	ug/Kg	250	
100-41-4	Ethylbenzene	BRL	ug/Kg	250	
08-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	250	
95-47-6	ortho-Xylene	BRL	ug/Kg	250	
100-42-5	Styrene	BRL	ug/Kg	250	
75-25-2	Bromoform	BRL	ug/Kg	250	
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	250	

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	119 %	80 - 120 %	
1,2-Dichloroethane-d ₄	119 %	80 - 120 %	
Toluene-d ₈	105 %	81 - 117 %	
4-Bromofluorobenzene	115 %	74 - 121 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified by the Target Compound List (TCL) of the US EPA Contract Laboratory Program. Results are reported on a dry weight basis.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.

Indicates additional target analyte.



Category: Inorganic Chemistry

Matrix: Soil

Analyte	Method	QC Batch	Units	Spiked	Measured	Recovery	QC Limits
Organic Carbon, Total	EPA 9060 Mod	TOC-0200-S	mg/Kg	1,000	990	99 %	80 - 120 %
Organic Carbon, Total	EPA 9060 Mod	TOC-0199-S	mg/Kg	1,000	1,000	100 %	80 - 120 %

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA,

EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA

Eighteenth Edition (1992). Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III

Results are reported on a dry weight basis.

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology,

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Category: Inorganic Chemistry

Matrix: Soi

Analyte	Result	Units	Reporting Limit	QC Batch	Method
Organic Carbon, Total	BRL mg		100	TOC-0200-S	EPA 9060 Mod
Organic Carbon, Total	BRL	mg/Kg	100	TOC-0199-S	EPA 9060 Mod

Method References: Methods for Chemical Analysis of Water and Wastes, US EPA, EPA-600/4-790-020, Revised (1983), and

Methods for the Determination of Inorganic Substances in Environmental Samples, US EPA,

EPA/600/R-93/100, (1993), Standard Methods for the Examination of Water and Wastewater, APHA, Eighteent Edition (1992). Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Results are reported on a dry weight basis.

Report Notations: BRL Indicates result, if any, is below reporting limit for analyte. Reporting limit is the lowest

value that can be reliably quantified under routine laboratory operating conditions.



Certifications and Approvals

Groundwater Analytical maintains environmental laboratory certification in a variety of states. Copies of our current certificates may be obtained from our website:

http://www.groundwateranalytical.com/qualifications.htm

CONNECTICUT, Department of Health Services, PH-0586

Categories: Potable Water, Wastewater, Solid Waste and Soil

http://www.dph.state.ct.us/BRS/Environmental Lab/OutStateLabList.htm

FLORIDA, Department of Health, Bureau of Laboratories, E87643

Categories: SDWA, CWA, RCRA/CERCLA http://www.floridadep.org/labs/qa/dohforms.htm

MAINE, Department of Human Services, MA103

Categories: Drinking Water and Wastewater

http://www.state.me.us/dhs/eng/water/Compliance.htm

MASSACHUSETTS, Department of Environmental Protection, M-MA-103

Categories: Potable Water and Non-Potable Water http://www.state.ma.us/dep/bspt/wes/files/certlabs.pdf

NEW HAMPSHIRE, Department of Environmental Services, 202703

Categories: Drinking Water and Wastewater

http://www.des.state.nh.us/asp/NHELAP/labsview.asp

NEW YORK, Department of Health, 11754

Categories: Potable Water, Non-Potable Water and Solid Waste

http://www.wadsworth.org/labcert/elap/comm.html

PENNSYLVANIA, Department of Environmental Protection, 68-665

Environmental Laboratory Registration (Non-drinking water and Non-wastewater) http://www.dep.state.pa.us/Labs/Registered/

RHODE ISLAND, Department of Health, 54

Categories: Surface Water, Air, Wastewater, Potable Water, Sewage

http://www.healthri.org/labs/labsCT_MA.htm

U.S. Department of Agriculture, Soil Permit, S-53921

Foreign soil import permit

VERMONT, Department of Environmental Conservation, Water Supply Division

Category: Drinking Water

http://www.vermontdrinkingwater.org/wsops/labtable.PDF

GROUNDWATER ANALYTICAL

June 10, 2003

Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532

Telephone (508) 759-4441 FAX (508) 759-4475 www.groundwateranalytical.com

Mr. Mike Webster Geolnsight, Inc. 319 Littleton Rd. Suite 105 Westford, MA 01886

LABORATORY REPORT

Project:

60 Olympia/2491

Lab ID: Received: 61629 06-03-03

Dear Mike:

Enclosed are the analytical results for the above referenced project. The project was processed for Priority turnaround.

This letter authorizes the release of the analytical results, and should be considered a part of this report. This report contains a sample receipt report detailing the samples received, a project narrative indicating project changes and non-conformances, a quality control report, and a statement of our state certifications.

The analytical results contained in this report meet all applicable NELAC standards, except as may be specifically noted, or described in the project narrative. This report may only be used or reproduced in its entirety.

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Should you have any questions concerning this report, please do not hesitate to contact me.

Sincerely,

Jonathan R. Sanford

President

JRS/smd Enclosures



Sample Receipt Report

Project: 60 Olympia/2491 Client: GeoInsight, Inc. Lab ID: 61629

Delivery: GWA Courier

Temperature: 2.0'C Chain of Custody: Present

Airbill: n/a Lab Receipt: 06-03-03

Custody Seal(s): n/a

Lab ID	Field ID		Matrix	Sampled	Method			Notes
61629-1	OL-005		Aqueous	6/2/03 9:55	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282154	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	
C282178	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	
C282166	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
61629-2	MW-145		Aqueous	6/2/03 10:40	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282139	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	
C282151	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	
C282128	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	

Lab ID	Field ID		Matrix	Sampled	Method	Livery In		Notes
61629-3	OL-003		Aqueous	6/2/03 11:15	EPA 8260B V	olatile Organic		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C279295	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03	
C279307	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03	
C279319	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03	

Lab ID	Field ID	W	Matrix	Sampled	Method			Notes	
61629-4	OL-3M		Aqueous	6/2/03 11:40	EPA 8260B V	olatile Organic	s		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship		
C279258	40 mL VOA Vial	Industrial	BX7788	HCI	ƙ-3449B	05-05-03	05-19-03	To Historia	
C279270	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03		
C279282	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03		

Lab ID	Field ID		Matrix	Sampled	Method			Notes
61629-5	MW-013		Aqueous	6/2/03 12:10	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C279267	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03	
C279311	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03	
C279279	40 mL VOA Vial	Industrial	BX7788	HCI	R-3449B	05-05-03	05-19-03	

Lab ID	Field ID		Matrix	Sampled	Method			Notes
61629-6	Test-1	Y TELL	Aqueous	6/2/03 12:55	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282973	40 mL VOA Vial	Industrial	BX7817	HCl	R-3449B	05-05-03	05-19-03	
C282949	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	
C282961	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	

Lab ID	Field 1D		Matrix	Sampled	Method			Notes
61629-7	OL-2M		Aqueous	6/2/03 13:30	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282917	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	
C282929	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	
C282941	40 mL VOA Vial	Industrial	BX7817	HCI	R-3449B	05-05-03	05-19-03	



Sample Receipt Report (Continued)

Project: 60 Olympia/2491 Client: GeoInsight, Inc. Lab ID: 61629

Delivery: GWA Courier Airbill: n/a

Temperature: 2.0'C Chain of Custody: Present

Lab Receipt: 06-03-03

Custody Seal(s): n/a

Lab ID	Field ID		Matrix	Sampled	Method			Notes
61629-8	OL-002		Aqueous	6/2/03 14:00	EPA 8260B V	olatile Organic	5	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C282127	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	
C282150	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	
C282134	40 mL VOA Vial	Industrial	BX7813	HCI	R-3449B	05-05-03	05-19-03	



EPA Method 8260B Volatile Organics by GC/MS

Laboratory ID:

QC Batch ID:

61629-01

VM4-2621-W

Field ID: OL-005
Project: 60 Olympia/2491
Client: Geolnsight, Inc.

Client: GeoInsight, Inc. Sampled: 06-02-03
Container: 40 mL VOA Vial Received: 06-03-03
Preservation: HCl / Cool Analyzed: 06-04-03

Matrix: Aqueous Dilution Factor: 1
Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	2	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5



EPA Method 8260B (Continued) Volatile Organics by GC/MS

Field ID:

OL-005

Laboratory ID:

61629-01

Project:

60 Olympia/2491

QC Batch ID:

VM4-2621-W

Client:

Geolnsight, Inc.

Sampled:

06-02-03

Container: Preservation: 40 mL VOA Vial

Received:

06-03-03

Matrix:

HCI / Cool Aqueous

Analyzed:

06-04-03

Dilution Factor:

Page:

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CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n-Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert- Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5
135-98-8	sec-Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5
104-51-8	n-Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	94 %	86 - 118 %
1,2-Dichloroethane-d4	94 %	80 - 120 %
Toluene-d ₈	105 %	88 - 110 %
4-Bromofluorobenzene	102 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

MW-14S

Project: Client:

60 Olympia/2491

Container:

Matrix:

Geolnsight, Inc. 40 mL VOA Vial

Preservation:

HCI / Cool Aqueous

Laboratory ID:

61629-02

QC Batch ID:

VM4-2621-W

Sampled:

06-02-03

Received:

06-03-03

Analyzed:

Dilution Factor:

06-05-03

Page:

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2

Analyte	Concentration	Units	Reporting Limi
Dichlorodifluoromethane	BRL	ug/L	1
Chloromethane	BRL	ug/L	1
Vinyl Chloride	16	ug/L	1
Bromomethane	BRL	ug/L	1
Chloroethane	BRL	ug/L	1
Trichlorofluoromethane	BRL	ug/L	1
Diethyl Ether	BRL	ug/L	4
1,1-Dichloroethene	BRL	ug/L	1
1,1,2-Trichlorotrifluoroethane	BRL	ug/L	10
Acetone	BRL	ug/L	20
Carbon Disulfide	BRL	ug/L	10
Methylene Chloride	BRL	ug/L	5
trans-1,2-Dichloroethene	BRL		1
The state of the s	BRL		1
THE STATE OF THE S	BRL		1
	BRL		1
A STATE OF THE ACT OF THE PROPERTY OF THE PROP	62		1
The state of the s	BRL		10
Bromochloromethane	BRL		1
Tetrahydrofuran (THF)	BRL		10
			1
A STATE OF THE STA			1
			1
			1
			1
			1
Trichloroethene	15		1
	BRL		1
Dibromomethane	BRL		1
Bromodichloromethane	BRL		1
cis-1,3-Dichloropropene	BRL		1
			10
			1
			1
			1
			1 1 1
			1
	10/10/00		10
			1
STATE OF THE STATE	The state of the s		1
CONTRACTOR OF SECURIOR SECURIO			1
			1
Ethylbenzene	BRL	ug/L	1
	Dichlorodifluoromethane Chloromethane Vinyl Chloride Bromomethane Chloroethane Trichlorofluoromethane Diethyl Ether 1,1-Dichloroethene 1,1,2-Trichlorotrifluoroethane Acetone Carbon Disulfide Methylene Chloride trans-1,2-Dichloroethene Methyl tert- butyl Ether (MTBE) 1,1-Dichloroethane 2,2-Dichloropropane cis-1,2-Dichloroethene 2-Butanone (MEK) Bromochloromethane Tetrahydrofuran (THF) Chloroform 1,1,1-Trichloroethane Carbon Tetrachloride 1,1-Dichloropropene Benzene 1,2-Dichloropropane 1,2-Dichloropropane Dibromomethane Trichloroethene 1,2-Dichloropropane Dibromomethane Trichloroethene 1,2-Dichloropropene 4-Methyl-2-Pentanone (MIBK) Toluene trans-1,3-Dichloropropene 1,1,2-Trichloroethane Tetrachloroethene 1,3-Dichloropropane Dibromochloromethane Tetrachloroethene 1,3-Dichloropropane 2-Hexanone Dibromochloromethane Tetrachloroethene 1,2-Dibromoethane (EDB) Chlorobenzene 1,1,1,2-Tetrachloroethane	Dichlorodifluoromethane Chloromethane Chloromethane Chlorodethane Bru Vinyl Chloride Bromomethane Bru Chloroethane Bru Trichlorofluoromethane Bru Diethyl Ether Bru 1,1-Dichloroethene Bru 1,1,2-Trichlorotrifluoroethane Acetone Bru Carbon Disulfide Bru Methylene Chloride Bru Methylene Chloride Bru 1,1-Dichloroethane Bru 2,2-Dichloropropane Bru 2,2-Dichloropropane Bru Cis-1,2-Dichloroethene Bru Bru Bromochloromethane Bru 1,1,1-Trichloroethane Bru 1,2-Dichloropropene Bru Bru 1,2-Dichloropropene Bru Bru 1,2-Dichloropropene Bru Bru Trichloroethane Bru Trichloroethane Bru Dibromomethane Bru Bru Dibromomethane Bru Bru Bru Dibromomethane Bru Bru Bru Dibromomethane Bru Bru Bru Bru Bru Bru Bru Bru Bru Bru	Dichlorodifluoromethane



Field ID:

MW-145

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation: Matrix:

HCI / Cool Aqueous

Laboratory ID:

61629-02

QC Batch ID:

VM4-2621-W

Sampled:

06-02-03

Received:

06-03-03

Analyzed:

06-05-03

Dilution Factor: 2

Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	1
95-47-6	ortho-Xylene	BRL	ug/L	1
100-42-5	Styrene	BRL	ug/L	1
75-25-2	Bromoform	BRL	ug/L	1
98-82-8	Isopropylbenzene	BRL	ug/L	1
108-86-1	Bromobenzene	BRL	ug/L	1
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	1
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	1
103-65-1	n -Propylbenzene	BRL	ug/L	1
95-49-8	2-Chlorotoluene	BRL	ug/L	1
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	1
106-43-4	4-Chlorotoluene	BRL	ug/L	1
98-06-6	tert- Butylbenzene	BRL	ug/L	1
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	1
135-98-8	sec-Butylbenzene	BRL	ug/L	1
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	1
99-87-6	4-Isopropyltoluene	BRL	ug/L	1
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	1
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	1
104-51-8	n-Butylbenzene	BRL	ug/L	1
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	1
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	1
87-68-3	Hexachlorobutadiene	BRL	ug/L	1
91-20-3	Naphthalene	BRL	ug/L	1
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	1

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	97 %	86 - 118 %
1,2-Dichloroethane-d ₄	100 %	80 - 120 %
Toluene-d ₈	103 %	88 - 110 %
4-Bromofluorobenzene	101 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

OL-003

Project: 60 Olympia/2491

Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: HCI / Cool

Preservation: Matrix:

Aqueous

Laboratory ID:

61629-03

QC Batch ID: VM4-2621-W

Sampled: 06-02-03 Received: 06-03-03 Analyzed: 06-05-03

Dilution Factor: 1

Page: 1 of 2

	rage. Tota			
CAS Number	Analyte	Concentration	Units	Reporting Lim
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	7	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	11	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	2	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	0.8	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	3	ug/L	0.5
100-41-4	Luiyiberizene	3	ug/L	0.5



HCI / Cool

Preservation:

EPA Method 8260B (Continued) Volatile Organics by GC/MS

Analyzed:

Laboratory ID: Field ID: OL-003 61629-03 QC Batch ID: Project: 60 Olympia/2491 VM4-2621-W Client: Geolnsight, Inc. Sampled: 06-02-03 40 mL VOA Vial Received: 06-03-03 Container: 06-05-03

Dilution Factor: Matrix: Aqueous 1 2 of 2 Page:

CAS Number	Analyte	Concentration	Units	Reporting Limi
08-38-3/106-42-3	meta- Xylene and para- Xylene	7	ug/L	0.5
95-47-6	ortho- Xylene	2	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n-Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert-Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	0.8	ug/L	0.5
135-98-8	sec -Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	0.7	ug/L	0.5
104-51-8	n-Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	93 %	80 - 120 %
Toluene-d ₈	105 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list

as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective

12/1/97. Analysis performed utilizing 25mL sample purge volume.

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest Report Notations:

concentration that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.



Field ID:

OL-3M

Project:

60 Olympia/2491

Client: Container: Geolnsight, Inc. 40 mL VOA Vial

Preservation: Matrix:

HCl / Cool

Aqueous

Laboratory ID:

61629-04

QC Batch ID:

VM4-2621-W

Sampled:

06-02-03

Received:

06-03-03 06-05-03

Analyzed: Dilution Factor:

1

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		Page:	1 01 2	
CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5
79-01-6	Trichloroethene	BRL	ug/L	0.5
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	BRL	ug/L	0.5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5
108-90-7	Chlorobenzene	BRL	ug/L	0.5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5



Field ID:

OL-3M

60 Olympia/2491

Project: Client:

Geolnsight, Inc.

Container: Preservation: 40 mL VOA Vial HCI / Cool

Matrix:

Aqueous

Laboratory ID:

61629-04

QC Batch ID:

VM4-2621-W

Sampled:

06-02-03

Received:

06-03-03

Analyzed:

06-05-03

Dilution Factor:

1

Page:

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CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n-Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert-Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5
135-98-8	sec-Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5
104-51-8	n-Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	96 %	80 - 120 %
Toluene-d ₈	104 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

MW-013

Project: Client:

60 Olympia/2491 Geolnsight, Inc.

Container: Preservation: 40 mL VOA Vial HCI / Cool

Matrix:

Aqueous

Laboratory ID:

61629-05

QC Batch ID: Sampled:

VM4-2621-W 06-02-03

Received:

06-03-03

Analyzed:

Dilution Factor:

06-05-03 50

Page:

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		i age.	1012	
CAS Number	Analyte	Concentration	Units	Reporting Lim
75-71-8	Dichlorodifluoromethane	BRL	ug/L	25
74-87-3	Chloromethane	BRL	ug/L	25
75-01-4	Vinyl Chloride	BRL	ug/L	25
74-83-9	Bromomethane	BRL	ug/L	25
75-00-3	Chloroethane	BRL	ug/L	25
75-69-4	Trichlorofluoromethane	BRL	ug/L	25
60-29-7	Diethyl Ether	BRL	ug/L	100
75-35-4	1,1-Dichloroethene	BRL	ug/L	25
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	250
67-64-1	Acetone	BRL	ug/L	500
75-15-0	Carbon Disulfide	BRL	ug/L	250
75-09-2	Methylene Chloride	BRL	ug/L	130
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	25
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	25
75-34-3	1,1-Dichloroethane	BRL	ug/L	25
590-20-7	2,2-Dichloropropane	BRL	ug/L	25
156-59-2	cis-1,2-Dichloroethene	1,300	ug/L	25
78-93-3	2-Butanone (MEK)	BRL	ug/L	250
74-97-5	Bromochloromethane	BRL	ug/L	25
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	250
67-66-3	Chloroform	BRL	ug/L	25
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	25
56-23-5	Carbon Tetrachloride	BRL	ug/L	25
563-58-6	1,1-Dichloropropene	BRL	ug/L	25
71-43-2	Benzene	BRL	ug/L	25
107-06-2	1,2-Dichloroethane	BRL	ug/L	25
79-01-6	Trichloroethene	250	ug/L	25
78-87-5	1,2-Dichloropropane	BRL	ug/L	25
74-95-3	Dibromomethane	BRL	ug/L	25
75-27-4	Bromodichloromethane	BRL	ug/L	25
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	25
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	250
108-88-3	Toluene	BRL	ug/L	25
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	25
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	25
127-18-4	Tetrachloroethene	430	ug/L	25
142-28-9	1,3-Dichloropropane	BRL	ug/L	25
591-78-6	2-Hexanone	BRL	ug/L	250
124-48-1	Dibromochloromethane	BRL	ug/L	25
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	25
108-90-7	Chlorobenzene	BRL	ug/L	25
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	25
100-41-4	Ethylbenzene	BRL	ug/L	25



MW-013 Laboratory ID: 61629-05 Field ID: QC Batch ID: Project: 60 Olympia/2491 VM4-2621-W Client: Geolnsight, Inc. Sampled: 06-02-03 40 mL VOA Vial Received: 06-03-03 Container: Preservation: HCI / Cool Analyzed: 06-05-03 Dilution Factor: 50 Matrix: Aqueous

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CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	25
95-47-6	ortho-Xylene	BRL	ug/L	25
100-42-5	Styrene	BRL	ug/L	25
75-25-2	Bromoform	BRL	ug/L	25
98-82-8	Isopropylbenzene	BRL	ug/L	25
108-86-1	Bromobenzene	BRL	ug/L	25
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	25
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	25
103-65-1	n-Propylbenzene	BRL	ug/L	25
95-49-8	2-Chlorotoluene	BRL	ug/L	25
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	25
106-43-4	4-Chlorotoluene	BRL	ug/L	25
98-06-6	tert- Butylbenzene	BRL	ug/L	25
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	25
135-98-8	sec -Butylbenzene	BRL	ug/L	25
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	25
99-87-6	4-Isopropyltoluene	BRL	ug/L	25
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	25
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	25
104-51-8	n-Butylbenzene	BRL	ug/L	25
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	25
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	25
87-68-3	Hexachlorobutadiene	BRL	ug/L	25
91-20-3	Naphthalene	BRL	ug/L	25
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	25

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	97 %	86 - 118 %
1,2-Dichloroethane-d ₄	97 %	80 - 120 %
Toluene-d ₈	105 %	88 - 110 %
4-Bromofluorobenzene	102 %	86 - 115 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1

as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEF Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective

12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations: BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest

concentration that can be reliably quantified under routine laboratory operating conditions.

Reporting limits are adjusted for sample dilution and sample size.



Field ID: Test-1 Project: 60 Olympia/2491

Client: Geolnsight, Inc.
Container: 40 mL VOA Vial
Preservation: HCl / Cool

Matrix: Aqueous

Laboratory ID: 61629-06 QC Batch ID: VM4-2623-W

Sampled: 06-02-03 Received: 06-03-03 Analyzed: 06-06-03

Dilution Factor: 5
Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Lin			
75-71-8	Dichlorodifluoromethane	BRL	ug/L	2.5			
74-87-3	Chloromethane	BRL	ug/L	2.5			
75-01-4	Vinyl Chloride	3	ug/L	2.5			
74-83-9	Bromomethane	BRL	ug/L	2.5			
75-00-3	Chloroethane	BRL	ug/L	2.5			
75-69-4	Trichlorofluoromethane	BRL	ug/L	2.5			
60-29-7	Diethyl Ether	BRL	ug/L	10			
75-35-4	1,1-Dichloroethene	BRL	ug/L	2.5			
76-13-1	1,1,2-Trichlorotrifluoroethane	170	ug/L	25			
67-64-1	Acetone	BRL	ug/L	50			
75-15-0	Carbon Disulfide	BRL	ug/L	25			
75-09-2	Methylene Chloride	BRL	ug/L	13			
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	2.5			
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	2.5			
75-34-3	1,1-Dichloroethane	BRL	ug/L	2.5			
590-20-7	2,2-Dichloropropane	BRL	ug/L	2.5			
156-59-2	cis-1,2-Dichloroethene	130	ug/L	2.5			
78-93-3	2-Butanone (MEK)	BRL	ug/L	25			
74-97-5	Bromochloromethane	BRL	ug/L	2.5			
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	25			
67-66-3	Chloroform	5	ug/L	2.5			
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	2.5			
56-23-5	Carbon Tetrachloride	BRL	ug/L	2.5			
563-58-6	1,1-Dichloropropene	BRL	ug/L	2.5			
71-43-2	Benzene	BRL	ug/L	2.5			
107-06-2	1,2-Dichloroethane	BRL	ug/L	2.5			
79-01-6	Trichloroethene	1,300	ug/L	2.5			
78-87-5	1,2-Dichloropropane	BRL	ug/L	2.5			
74-95-3	Dibromomethane	BRL	ug/L	2.5			
75-27-4	Bromodichloromethane	14	ug/L	2.5			
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	2.5			
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	25			
108-88-3	Toluene	BRL	ug/L	2.5			
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	2.5			
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	2.5			
127-18-4	Tetrachloroethene	3	ug/L	2.5			
142-28-9	1,3-Dichloropropane	BRL	ug/L	2.5			
591-78-6	2-Hexanone	BRL	ug/L	25			
124-48-1	Dibromochloromethane	BRL	ug/L	2.5			
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	2.5			
108-90-7	Chlorobenzene	BRL	ug/L	2.5			
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	2.5			
100-41-4	Ethylbenzene	BRL	ug/L	2.5			



Field ID: Test-1
Project: 60 Olympia/2491

Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: HCl / Cool

Matrix: Aqueous

Laboratory ID: 61629-06

QC Batch ID: VM4-2623-W Sampled: 06-02-03 Received: 06-03-03

Analyzed: 06-06-03

Dilution Factor: 5
Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	2.5
95-47-6	ortho- Xylene	BRL	ug/L	2.5
100-42-5	Styrene	BRL	ug/L	2.5
75-25-2	Bromoform	BRL	ug/L	2.5
98-82-8	Isopropylbenzene	BRL	ug/L	2.5
108-86-1	Bromobenzene	BRL	ug/L	2.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	2.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	2.5
103-65-1	n-Propylbenzene	BRL	ug/L	2.5
95-49-8	2-Chlorotoluene	BRL	ug/L	2.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	2.5
106-43-4	4-Chlorotoluene	BRL	ug/L	2.5
98-06-6	tert- Butylbenzene	BRL	ug/L	2.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	2.5
135-98-8	sec -Butylbenzene	BRL	ug/L	2.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	2.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	2.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	2.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	2.5
104-51-8	n-Butylbenzene	BRL	ug/L	2.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	2.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	2.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	2.5
91-20-3	Naphthalene	BRL	ug/L	2.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	2.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	99 %	86 - 118 %
1,2-Dichloroethane-d ₄	99 %	80 - 120 %
Toluene-d ₈	105 %	88 - 110 %
4-Bromofluorobenzene	105 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

RL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID:

OL-2M

Project: Client:

60 Olympia/2491

Container:

Geolnsight, Inc. 40 mL VOA Vial

Preservation: Matrix:

HCI / Cool Aqueous

Laboratory ID:

61629-07

QC Batch ID:

VM4-2621-W

Sampled:

06-02-03

Received:

06-03-03

Analyzed: Dilution Factor: 06-05-03

1

Page:

1 of 2

		Page:	1 of 2							
CAS Number	Analyte	Concentration	Units	Reporting Limi						
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5						
74-87-3	Chloromethane	BRL	ug/L	0.5						
75-01-4	Vinyl Chloride	BRL	ug/L	0.5						
74-83-9	Bromomethane	BRL	ug/L	0.5						
75-00-3	Chloroethane	BRL	ug/L	0.5						
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5						
60-29-7	Diethyl Ether	BRL	ug/L	2						
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5						
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5						
67-64-1	Acetone	BRL	ug/L	10						
75-15-0	Carbon Disulfide	BRL	ug/L	5						
75-09-2	Methylene Chloride	BRL	ug/L	2.5						
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5						
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5						
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5						
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5						
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5						
78-93-3	2-Butanone (MEK)	BRL	ug/L	5						
74-97-5	Bromochloromethane	BRL	ug/L	0.5						
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5						
67-66-3	Chloroform	BRL	ug/L	0.5						
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5						
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5						
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5						
71-43-2	Benzene	BRL	ug/L	0.5						
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5						
79-01-6	Trichloroethene	BRL	ug/L	0.5						
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5						
74-95-3	Dibromomethane	BRL	ug/L	0.5						
75-27-4	Bromodichloromethane	BRL	ug/L	0.5						
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5						
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5						
108-88-3	Toluene	BRL	ug/L	0.5						
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5						
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5						
127-18-4	Tetrachloroethene	BRL	ug/L	0.5						
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5						
591-78-6	2-Hexanone	BRL	ug/L	5						
124-48-1	Dibromochloromethane	BRL	ug/L	0.5						
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	0.5						
108-90-7	Chlorobenzene	BRL	ug/L	0.5						
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5						
	TO SECURE A CONTRACT SERVICE AND A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURIOR AS A SECURE AS A SECURE AS A SECURE AS A SECURE AS A SECURIOR AS A S									
100-41-4	Ethylbenzene	BRL	ug/L	0.5						



Field ID:

OL-2M

Laboratory ID:

61629-07

Project:

60 Olympia/2491 Geolnsight, Inc.

QC Batch ID: Sampled:

VM4-2621-W 06-02-03

Client:

06-03-03

Container: Preservation: 40 mL VOA Vial

Received:

06-05-03

HCI / Cool

Analyzed: Dilution Factor:

Page:

2 of 2

1

Matrix: Aqueous

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta-Xylene and para-Xylene	BRL	ug/L	0.5
95-47-6	ortho-Xylene	BRL	ug/L	0.5
100-42-5	Styrene	BRL	ug/L	0.5
75-25-2	Bromoform	BRL	ug/L	0.5
98-82-8	Isopropylbenzene	BRL	ug/L	0.5
108-86-1	Bromobenzene	BRL	ug/L	0.5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5
103-65-1	n-Propylbenzene	BRL	ug/L	0.5
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5
106-43-4	4-Chlorotoluene	BRL	ug/L	0.5
98-06-6	tert- Butylbenzene	BRL	ug/L	0.5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5
135-98-8	sec-Butylbenzene	BRL	ug/L	0.5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5
104-51-8	n-Butylbenzene	BRL	ug/L	0.5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5
91-20-3	Naphthalene	BRL	ug/L	0.5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	95 %	86 - 118 %
1,2-Dichloroethane-d ₄	94 %	80 - 120 %
Toluene-d ₈	104 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Field ID: OL-002 Project: 60 Olympia/2491

Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: HCI / Cool

Matrix: Aqueous

Laboratory ID: 61629-08
QC Batch ID: VM4-2621-W

Sampled: 06-02-03 Received: 06-03-03 Analyzed: 06-05-03

Dilution Factor: 10 Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Lin				
75-71-8	Dichlorodifluoromethane	BRL	ug/L	5				
74-87-3	Chloromethane	BRL	ug/L	5				
75-01-4	Vinyl Chloride	BRL	ug/L	5				
74-83-9	Bromomethane	BRL	ug/L	5				
75-00-3	Chloroethane	BRL	ug/L	5				
75-69-4	Trichlorofluoromethane	BRL	ug/L	5				
60-29-7	Diethyl Ether	BRL	ug/L	20				
75-35-4	1,1-Dichloroethene	BRL	ug/L	5				
76-13-1	1,1,2-Trichlorotrifluoroethane	150	ug/L	50				
67-64-1	Acetone	BRL	ug/L	100				
75-15-0	Carbon Disulfide	BRL	ug/L	50				
75-09-2	Methylene Chloride	BRL	ug/L	25				
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	5				
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	5				
75-34-3	1,1-Dichloroethane	BRL	ug/L	5				
590-20-7	2,2-Dichloropropane	BRL	ug/L	5				
156-59-2	cis-1,2-Dichloroethene	17	ug/L	5				
78-93-3	2-Butanone (MEK)	BRL	ug/L	50				
74-97-5	Bromochloromethane	BRL	ug/L	5				
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	50				
67-66-3	Chloroform	BRL	ug/L	5				
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	5				
56-23-5	Carbon Tetrachloride	BRL	ug/L	5				
563-58-6	1,1-Dichloropropene	BRL	ug/L	5				
71-43-2	Benzene	BRL	ug/L	5				
107-06-2	1,2-Dichloroethane	BRL	ug/L	5				
79-01-6	Trichloroethene	330	ug/L	5				
78-87-5	1,2-Dichloropropane	BRL	ug/L	5				
74-95-3	Dibromomethane	BRL	ug/L	5				
75-27-4	Bromodichloromethane	BRL	ug/L	5				
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	5				
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	50				
108-88-3	Toluene	BRL	ug/L	5				
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	5				
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	5				
127-18-4	Tetrachloroethene	BRL	ug/L	5				
142-28-9	1,3-Dichloropropane	BRL	ug/L	5				
591-78-6	2-Hexanone	BRL	ug/L	50				
124-48-1	Dibromochloromethane	BRL	ug/L	5				
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/L	5				
108-90-7	Chlorobenzene	BRL	ug/L	5				
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	5				
100-41-4	Ethylbenzene	BRL	ug/L	5				



Field ID:

OL-002

Project: Client:

Matrix:

60 Olympia/2491

Container:

Geolnsight, Inc. 40 mL VOA Vial

Preservation:

HCI / Cool

Aqueous

Laboratory ID:

61629-08

QC Batch ID:

VM4-2621-W

Sampled:

06-02-03

Received:

06-03-03

Analyzed:

06-05-03

Dilution Factor:

10

Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	5
95-47-6	ortho-Xylene	BRL	ug/L	5
100-42-5	Styrene	BRL	ug/L	5
75-25-2	Bromoform	BRL	ug/L	5
98-82-8	Isopropylbenzene	BRL	ug/L	5
108-86-1	Bromobenzene	BRL	ug/L	5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	5
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	5
103-65-1	n-Propylbenzene	BRL	ug/L	5
95-49-8	2-Chlorotoluene	BRL	ug/L	5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	5
106-43-4	4-Chlorotoluene	BRL	ug/L	5
98-06-6	tert- Butylbenzene	BRL	ug/L	5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	5
135-98-8	sec-Butylbenzene	BRL	ug/L	5
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	5
99-87-6	4-Isopropyltoluene	BRL	ug/L	5
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	5
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	5
104-51-8	n-Butylbenzene	BRL	ug/L	5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	5
87-68-3	Hexachlorobutadiene	BRL	ug/L	5
91-20-3	Naphthalene	BRL	ug/L	5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	5

QC Surrogate Compounds	Recovery	QC Limits				
Dibromofluoromethane	97 %	86 - 118 %				
1,2-Dichloroethane-d ₄	95 %	80 - 120 %				
Toluene-d ₈	106 %	88 - 110 %				
4-Bromofluorobenzene	102 %	86 - 115 %				

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution and sample size.



Project Narrative

Project: Client: 60 Olympia/2491 Geolnsight, Inc. Lab ID:

61629

Received:

06-03-03 18:55

A. Documentation and Client Communication

The following documentation discrepancies, and client changes or amendments were noted for this project:

No discrepancies, changes, or amendments were noted.

B. Method Non-Conformances

The following method non-conformances were noted for this project:

No method non-conformances were noted.

GROUNDWATER ANALYTICAL	228 Main Str Buzzards Ba Telephone (5 www.ground	y, MA 02 08) 759	532 4441 •	FAX (508	759-4	475		Laboration of the laboratory o	AIN-		ALCOHOLD TO	No. of the last	DY RECORD R																	N	0	0	73	210	6	
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Project Number:	Address:		TLE	TON)		Y ₀	RUSH	RITY (: H (RAN requires !	1-		100	nber)	OPTIONS	C) TIC Search			C) Acid Only C) B/N Only C) TIC Search			Specify For Water Samples	C Dissolved						Herbicides	tability, Reactivity							
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SAMPLE IDENTIFICATION	GROUNDWATER DRINKING WATER WASTEWATER SOIL	OTHER SOLID OIL/ORGANIC LIQUID	COMPOSITE GRAB	NUMBER 40mL VOA Vial 60mL/2 oz Glass	250mL/8 oz Glass	1032 oz Amber Glass 250mL/8 oz Piastic	500mL/16 az Plastic 1L/32 az Plastic 120ml Sheile		Presi	Nethanol Methanol	Sodium Bisuffate uo	Filtered	LABORATORY NUMBER (Lab Use Only)	RCRA/21E	C) 82609 TCL+MTBE	and the second s	D 80218 Malocarbons D 60 80218 D 60 80218	C) 8270C PAHs only	D 8061A Pesticides C	D 8151A Harbicides	C S HCRA CO S HC	C Specific	D TPH-IR D Diesel Range Organics (DRC	C CT ETPH C MA DEP EPH w/all targets (O Hydrocarbon Fingerprint (Gl	CIFPH by GC/FID (8100 Mod)	O MA DEP VPH w/all targets C	O TOUR O SPUR CO & Metals C	C Garrellonny (see pro)	O Mitrate (3 Miltitle (3 Chloride	☐ Dissolved Phosphorus ☐ Ammonia ☐ TKN ☐ Total Pi	CI Cit & Greate	C) C00 C1 T0C	Cyande, Total Ci Cyande, P	D hit C Dissolved Oxygen C	O Total Coliform O Fecal Colif
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		□MA	□NY	GW-2/S STARS king Wate	0				Petir 2/	nquished	Your			C/2/33		1855- Olalli							Container Count:													
			□ Was	tewater te Dispos	al				Relinquished by: Date					Time	Time Received by Laboratory:							Shipping/Airbill Number:														
5.2			□ Dre	lge Mater	rial				x Spike		ala		16.5			Meth	nod of St			Courier	☐ Express N	tail [] F	ederal l	Expres	ss						CL	ustod	ly Se	al		



Quality Assurance/Quality Control

A. Program Overview

Groundwater Analytical conducts an active Quality Assurance program to ensure the production of high quality, valid data. This program closely follows the guidance provided by *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, US EPA QAMS-005/80 (1980), and *Test Methods for Evaluating Solid Waste*, US EPA, SW-846, Update III (1996).

Quality Control protocols include written Standard Operating Procedures (SOPs) developed for each analytical method. SOPs are derived from US EPA methodologies and other established references. Standards are prepared from commercially obtained reference materials of certified purity, and documented for traceability.

Quality Assessment protocols for most organic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. All samples, standards, blanks, laboratory control samples, matrix spikes and sample duplicates are spiked with internal standards and surrogate compounds. All instrument sequences begin with an initial calibration verification standard and a blank; and excepting GC/MS sequences, all sequences close with a continuing calibration standard. GC/MS systems are tuned to appropriate ion abundance criteria daily, or for each 12 hour operating period, whichever is more frequent.

Quality Assessment protocols for most inorganic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. Standard curves are derived from one reagent blank and four concentration levels. Curve validity is verified by standard recoveries within plus or minus ten percent of the curve.

B. Definitions

Batches are used as the basic unit for Quality Assessment. A Batch is defined as twenty or fewer samples of the same matrix which are prepared together for the same analysis, using the same lots of reagents and the same techniques or manipulations, all within the same continuum of time, up to but not exceeding 24 hours.

Laboratory Control Samples are used to assess the accuracy of the analytical method. A Laboratory Control Sample consists of reagent water or sodium sulfate spiked with a group of target analytes representative of the method analytes. Accuracy is defined as the degree of agreement of the measured value with the true or expected value. Perent Recoveries for the Laboratory Control Samples are calculated to assess accuracy.

Method Blanks are used to assess the level of contamination present in the analytical system. Method Blanks consist of reagent water or an aliquot of sodium sulfate. Method Blanks are taken through all the appropriate steps of an analytical method. Sample data reported is not corrected for blank contamination.

Surrogate Compounds are used to assess the effectiveness of an analytical method in dealing with each sample matrix. Surrogate Compounds are organic compounds which are similar to the target analytes of interest in chemical behavior, but which are not normally found in environmental samples. Percent Recoveries are calculated for each Surrogate Compound.



Quality Control Report Laboratory Control Sample

Category: EPA Method 8260B QC Batch ID: VM4-2621-WL

Matrix: Aqueous

Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	5	5	109 %	70 - 130 %
71-43-2	Benzene	5	5	104 %	70 - 130 %
79-01-6	Trichloroethene	5	5	105 %	70 - 130 %
108-88-3	Toluene	5	5	107 %	70 - 130 %
108-90-7	Chlorobenzene	5	5	106 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	99 %	86 - 118 %
1,2-Dichloroethane-d ₄	99 %	80 - 120 %
Toluene-d ₈	103 %	88 - 110 %
4-Bromofluorobenzene	103 %	86 - 115 %

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Method Reference:

All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, Report Notations:

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: **EPA Method 8260B** QC Batch ID: **VM4-2621-WB**

Matrix: Aqueous

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Lim
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5
74-87-3	Chloromethane	BRL	ug/L	0.5
75-01-4	Vinyl Chloride	BRL	ug/L	0.5
74-83-9	Bromomethane	BRL	ug/L	0.5
75-00-3	Chloroethane	BRL	ug/L	0.5
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5
60-29-7	Diethyl Ether	BRL	ug/L	2
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5
67-64-1	Acetone	BRL	ug/L	10
75-15-0	Carbon Disulfide	BRL	ug/L	5
75-09-2	Methylene Chloride	BRL	ug/L	2.5
156-60-5	trans-1,2-Dichloroethene	BRL	ug/L	0.5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5
78-93-3	2-Butanone (MEK)	BRL	ug/L	5
74-97-5	Bromochloromethane	BRL	ug/L	0.5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5
67-66-3	Chloroform	BRL	ug/L	0.5
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5
71-43-2	Benzene	BRL	ug/L	0.5
107-06-2	1,2-Dichloroethane	ug/L	0.5	
79-01-6	Trichloroethene	ug/L	0.5	
78-87-5	1,2-Dichloropropane	BRL	ug/L	0.5
74-95-3	Dibromomethane	BRL	ug/L	0.5
75-27-4	Bromodichloromethane	BRL	ug/L	0.5
10061-01-5	cis- 1,3-Dichloropropene	BRL	ug/L	0.5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5
108-88-3	Toluene	BRL	ug/L	0.5
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/L	0.5
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5
127-18-4	Tetrachloroethene	BRL	ug/L	0.5
142-28-9	1,3-Dichloropropane	BRL	ug/L	0.5
591-78-6	2-Hexanone	BRL	ug/L	5
124-48-1	Dibromochloromethane	ug/L	0.5	
106-93-4	1,2-Dibromoethane (EDB)	BRL BRL	ug/L	0.5
108-90-7	Chlorobenzene	ug/L	0.5	
630-20-6	1,1,1,2-Tetrachloroethane	BRL BRL	ug/L	0.5
100-41-4	Ethylbenzene	BRL	ug/L	0.5



Quality Control Report Method Blank

Category: EPA Method 8260B QC Batch ID: VM4-2621-WB

Matrix: Aqueous Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit	
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5	
95-47-6	ortho- Xylene				
100-42-5	Styrene	BRL	ug/L	0.5	
75-25-2	Bromoform	BRL	ug/L	0.5	
98-82-8	Isopropylbenzene	BRL	ug/L	0.5	
108-86-1	Bromobenzene	BRL	ug/L	0.5	
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5	
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5	
103-65-1	n - Propylbenzene	BRL	ug/L	0.5	
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5	
108-67-8	1,3,5-Trimethylbenzene	5-Trimethylbenzene BRL			
106-43-4	4-Chlorotoluene	ug/L	0.5		
98-06-6	tert- Butylbenzene	BRL	ug/L	0.5	
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5	
135-98-8	sec-Butylbenzene	BRL	ug/L	0.5	
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5	
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5	
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5	
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5	
104-51-8	n-Butylbenzene	BRL	ug/L	0.5	
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5	
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5	
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5	
91-20-3	Naphthalene	BRL	ug/L	0.5	
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5	

QC Surrogate Compounds	Recovery	QC Limits		
Dibromofluoromethane	93 %	86 - 118 %		
1,2-Dichloroethane-d ₄	93 %	80 - 120 %		
Toluene-d ₈	104 %	88 - 110 %		
4-Bromofluorobenzene	103 %	86 - 115 %		

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Quality Control Report Laboratory Control Sample

Category: EPA Method 8260B QC Batch ID: VM4-2623-WL

> Matrix: Aqueous Units: ug/L

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits	
75-35-4	35-4 1,1-Dichloroethene		11	106 %	70 - 130 %	
71-43-2	43-2 Benzene		10	96 %	70 - 130 %	
79-01-6	Trichloroethene	10	10	98 %	70 - 130 %	
108-88-3 Toluene		10	10	98 %	70 - 130 %	
108-90-7 Chlorobenzene		10	10	96 %	70 - 130 %	

QC Surrogate Compounds	Recovery	QC Limits		
Dibromofluoromethane	101 %	86 - 118 %		
1,2-Dichloroethane-d ₄	100 %	80 - 120 %		
Toluene-d ₈	104 %	88 - 110 %		
4-Bromofluorobenzene	102 %	86 - 115 %		

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations:

All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.

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Quality Control Report Method Blank

Category: EPA Method 8260B
QC Batch ID: VM4-2623-WB
Matrix: Aqueous

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit	
75-71-8	Dichlorodifluoromethane	BRL	ug/L	0.5	
74-87-3	Chloromethane	BRL	ug/L	0.5	
75-01-4	Vinyl Chloride	BRL	ug/L	0.5	
74-83-9	Bromomethane	BRL	ug/L	0.5	
75-00-3	Chloroethane	BRL	ug/L	0.5	
75-69-4	Trichlorofluoromethane	BRL	ug/L	0.5	
60-29-7	Diethyl Ether	BRL	ug/L	2	
75-35-4	1,1-Dichloroethene	BRL	ug/L	0.5	
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/L	5	
67-64-1	Acetone	BRL	ug/L	10	
75-15-0	Carbon Disulfide	BRL	ug/L	5	
75-09-2	Methylene Chloride	BRL	ug/L	2.5	
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/L	0.5	
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/L	0.5	
75-34-3	1,1-Dichloroethane	BRL	ug/L	0.5	
590-20-7	2,2-Dichloropropane	BRL	ug/L	0.5	
156-59-2	cis-1,2-Dichloroethene	BRL	ug/L	0.5	
78-93-3	2-Butanone (MEK)	BRL	ug/L	5	
74-97-5	Bromochloromethane	BRL	ug/L	0.5	
109-99-9	Tetrahydrofuran (THF)	BRL	ug/L	5	
67-66-3	Chloroform	BRL	ug/L	0.5	
71-55-6	1,1,1-Trichloroethane	BRL	ug/L	0.5	
56-23-5	Carbon Tetrachloride	BRL	ug/L	0.5	
563-58-6	1,1-Dichloropropene	BRL	ug/L	0.5	
71-43-2	Benzene	BRL	ug/L	0.5	
107-06-2	1,2-Dichloroethane	BRL	ug/L	0.5	
79-01-6	Trichloroethene	BRL	ug/L	0.5	
78-87-5	1,2-Dichloropropane	W/1907-04-2007-1907-1907-1907-1907-1907-1907-1907-1		0.5	
74-95-3	Dibromomethane	ug/L	0.5		
75-27-4	Bromodichloromethane	BRL	ug/L	0.5	
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/L	0.5	
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/L	5	
108-88-3	Toluene	BRL	ug/L	0.5	
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/L	0.5	
79-00-5	1,1,2-Trichloroethane	BRL	ug/L	0.5	
127-18-4	Tetrachloroethene	BRL	ug/L	0.5	
142-28-9	1,3-Dichloropropane	ropane BRL		0.5	
591-78-6	2-Hexanone	none BRL		5	
124-48-1	Dibromochloromethane	ug/L ug/L	0.5		
106-93-4	1,2-Dibromoethane (EDB)	ug/L	0.5		
108-90-7	Chlorobenzene	BRL	ug/L	0.5	
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/L	0.5	
100-41-4	Ethylbenzene	BRL	ug/L	0.5	



Quality Control Report Method Blank

Category: EPA Method 8260B

QC Batch ID: VM4-2623-WB

Matrix: Aqueous

Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit	
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/L	0.5	
95-47-6	ortho- Xylene	BRL	ug/L	0.5	
100-42-5	Styrene	BRL	ug/L	0.5	
75-25-2	Bromoform	BRL	ug/L	0.5	
98-82-8	Isopropylbenzene	BRL	ug/L	0.5	
108-86-1	Bromobenzene	BRL	ug/L	0.5	
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/L	0.5	
96-18-4	1,2,3-Trichloropropane	BRL	ug/L	0.5	
103-65-1	n - Propylbenzene	BRL	ug/L	0.5	
95-49-8	2-Chlorotoluene	BRL	ug/L	0.5	
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/L	0.5	
106-43-4	4-Chlorotoluene	ug/L	0.5		
98-06-6	tert- Butylbenzene	ug/L	0.5		
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/L	0.5	
135-98-8	sec -Butylbenzene	BRL	ug/L	0.5	
541-73-1	1,3-Dichlorobenzene	BRL	ug/L	0.5	
99-87-6	4-Isopropyltoluene	BRL	ug/L	0.5	
106-46-7	1,4-Dichlorobenzene	BRL	ug/L	0.5	
95-50-1	1,2-Dichlorobenzene	BRL	ug/L	0.5	
104-51-8	n-Butylbenzene	BRL	ug/L	0.5	
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/L	0.5	
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/L	0.5	
87-68-3	Hexachlorobutadiene	BRL	ug/L	0.5	
91-20-3	Naphthalene	BRL	ug/L	0.5	
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/L	0.5	

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	96 %	86 - 118 %
1,2-Dichloroethane-d ₄	96 %	80 - 120 %
Toluene-d ₈	103 %	88 - 110 %
4-Bromofluorobenzene	104 %	86 - 115 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Analysis performed utilizing 25mL sample purge volume.

Report Notations:

BRL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Certifications and Approvals

Groundwater Analytical maintains environmental laboratory certification in a variety of states. Copies of our current certificates may be obtained from our website:

http://www.groundwateranalytical.com/qualifications.htm

CONNECTICUT, Department of Health Services, PH-0586

Categories: Potable Water, Wastewater, Solid Waste and Soil

http://www.dph.state.ct.us/BRS/Environmental Lab/OutStateLabList.htm

FLORIDA, Department of Health, Bureau of Laboratories, E87643

Categories: SDWA, CWA, RCRA/CERCLA http://www.floridadep.org/labs/qa/dohforms.htm

MAINE, Department of Human Services, MA103

Categories: Drinking Water and Wastewater

http://www.state.me.us/dhs/eng/water/Compliance.htm

MASSACHUSETTS, Department of Environmental Protection, M-MA-103

Categories: Potable Water and Non-Potable Water http://www.state.ma.us/dep/bspt/wes/files/certlabs.pdf

NEW HAMPSHIRE, Department of Environmental Services, 202703

Categories: Drinking Water and Wastewater

http://www.des.state.nh.us/asp/NHELAP/labsview.asp

NEW YORK, Department of Health, 11754

Categories: Potable Water, Non-Potable Water and Solid Waste

http://www.wadsworth.org/labcert/elap/comm.html

PENNSYLVANIA, Department of Environmental Protection, 68-665

Environmental Laboratory Registration (Non-drinking water and Non-wastewater) http://www.dep.state.pa.us/Labs/Registered/

RHODE ISLAND, Department of Health, 54

Categories: Surface Water, Air, Wastewater, Potable Water, Sewage

http://www.healthri.org/labs/labsCT_MA.htm

U.S. Department of Agriculture, Soil Permit, S-53921

Foreign soil import permit

VERMONT, Department of Environmental Conservation, Water Supply Division

Category: Drinking Water

http://www.vermontdrinkingwater.org/wsops/labtable.PDF

June 23, 2003

Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532

Telephone (508) 759-4441 FAX (508) 759-4475 www.groundwateranalytical.com

Ms. Christine Binger GeoInsight, Inc. 319 Littleton Rd. Suite 105 Westford, MA 01886

LABORATORY REPORT

Project:

Woburn Wells G & H/2491-001

Lab ID:

62088

Received:

06-16-03

Dear Christine:

Enclosed are the analytical results for the above referenced project. The project was processed for Priority turnaround.

This letter authorizes the release of the analytical results, and should be considered a part of this report. This report contains a sample receipt report detailing the samples received, a project narrative indicating project changes and non-conformances, a quality control report, and a statement of our state certifications.

The analytical results contained in this report meet all applicable NELAC standards, except as may be specifically noted, or described in the project narrative. This report may only be used or reproduced in its entirety.

I attest under the pains and penalties of perjury that, based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.

Should you have any questions concerning this report, please do not hesitate to contact me.

Sincerely,

Jonathan R. Sanford

President

JRS/smd Enclosures



Sample Receipt Report

Project: Woburn Wells G & H/2491-001

Client: Geolnsight, Inc.

Lab ID: 62088

Delivery: GWA Courier

Airbill: n/a

Lab Receipt: 06-16-03

Temperature: 3.0'C Chain of Custody: Present

Custody Seal(s): n/a

Lab ID			Matrix	Sampled	Method	Method		Notes
62088-1 Con ID			Soil	6/12/03 15:30 EPA 8260B Volatile Organics	Soil 6/12/03 15:30 QC Lot Preserv	EPA 8260B Volatile Organics		
	Container	Vendor	QC Lot	QC Lot		Prep	Ship	
C229910	40 mL VOA Vial	Industrial	BX6032	Methanol	R-3534AJ	02-04-03	n/a	Part Literature
C264313	40 mL VOA Vial	Industrial	BX7096	NaHSO4	R-3480B	03-24-03	n/a	
C264314	40 mL VOA Vial	Industrial	BX7096	NaHSO4	R-3480B	03-24-03	n/a	
C264312	40 mL VOA Vial	Industrial	BX7096	NaHSO4	R-3480B	03-24-03	n/a	

Lab ID	Field ID		Matrix	Sampled	Method	Method		Notes
62088-2	Geo-SB-92 (16')		Soil	6/12/03 14:15	EPA 8260B Volatile Organics			
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C229895	40 mL VOA Vial	Industrial	BX6032	Methanol	R-3534AJ	02-04-03	n/a	HALL-TIME TO SERVICE THE SERVI
C242283	40 mL VOA Vial	Industrial	BX7057	NaHSO4	R-3480B	03-24-03	n/a	
C242341	40 mL VOA Vial	Industrial	BX7057	NaHSO4	R-3480B	03-24-03	n/a	
C242342	40 mL VOA Vial	Industrial	BX7057	NaHSO4	R-3480B	03-24-03	n/a	

Lab ID	Lab ID Field ID		Matrix	Sampled	Method	Method		Notes
62088-3	Geo-5 (16')	i')		6/12/03 13:20	EPA 8260B Volatile Organics		THE STORY	Lug Lug Lug Langue
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C229899	40 mL VOA Vial	Industrial	BX6032	Methanol	R-3534AJ	02-04-03	n/a	
C242329	40 mL VOA Vial	Industrial	BX7057	NaHSO4	R-3480B	03-24-03	n/a	the House of the service
C242330	40 mL VOA Vial	Industrial	BX7057	NaHSO4	R-3480B	03-24-03	n/a	
C242331	40 mL VOA Vial	Industrial	BX7057	NaHSO4	R-3480B	03-24-03	n/a	

Lab ID	Field ID		Matrix	Sampled	Method	"ELIA"		Notes
62088-4 Geo-SB-91 (12')			Soil	6/12/03 15:30	EPA 9060 Mod	d Total Organ		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C213487	120 mL Amber Glass	Proline	BX6414	None	n/a	n/a	01-20-03	
C300996	250 mL Glass	Proline	BX8157	None	n/a	n/a	n/a	

Lab ID	Field ID		Matrix	Sampled	Method EPA 9060 Mod Total Organic Carbon		Notes	
62088-5	Geo-SB-92 (16')		Soil	6/12/03 14:15			ic Carbon	
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship	
C213488	120 mL Amber Glass	Proline	BX6414	None	n/a	n/a	01-20-03	
C301897	250 mL Glass	Proline	BX8159	None	n/a	n/a	n/a	

Lab ID	Field ID		Matrix	Sampled	Method			Notes		
62088-6	Geo-5 (16')		Soil	Soil	Soil 6/12	6/12/03 13:20	6/12/03 13:20 EPA 9060 Mod Total Organic Carbon	EPA 9060 Mod Total Organic Carbon		
Con ID	Container	Vendor	QC Lot	Preserv	QC Lot	Prep	Ship			
C213493	120 mL Amber Glass	Proline	BX6414	None	n/a	n/a	01-20-03			
C301892	250 mL Glass	Proline	BX8159	None	n/a	n/a	n/a	arabay, a language a series		



Field ID: Geo-SB-91 (12')

Project: Woburn Wells G & H/2491-001

Client: GeoInsight, Inc.
Container: 40 mL VOA Vial
Preservation: NaHSO4 / Cool

Matrix: Soil % Moisture: 28

Laboratory ID: 62088-01
QC Batch ID: VM1-1364-S
Sampled: 06-12-03
Received: 06-16-03

Received: 06-16-03 Analyzed: 06-20-03

Dilution Factor: 1 Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/Kg	13
74-87-3	Chloromethane	BRL	ug/Kg	13
75-01-4	Vinyl Chloride	BRL	ug/Kg	13
74-83-9	Bromomethane	BRL	ug/Kg	13
75-00-3	Chloroethane	BRL	ug/Kg	13
75-69-4	Trichlorofluoromethane	BRL	ug/Kg	13
60-29-7	Diethyl Ether	BRL	ug/Kg	13
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	7
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/Kg	66
67-64-1	Acetone	BRL	ug/Kg	260
75-15-0	Carbon Disulfide	BRL	ug/Kg	66
75-09-2	Methylene Chloride	BRL	ug/Kg	66
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/Kg	7
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/Kg	7
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	7
590-20-7	2,2-Dichloropropane	BRL	ug/Kg	7
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	7
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	66
74-97-5	Bromochloromethane	BRL	ug/Kg	7
109-99-9	Tetrahydrofuran (THF)	BRL	ug/Kg	66
67-66-3	Chloroform	BRL	ug/Kg	7
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	7
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	7
563-58-6	1,1-Dichloropropene	BRL	ug/Kg	7
71-43-2	Benzene	BRL	ug/Kg	7
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	7
79-01-6	Trichloroethene	BRL	ug/Kg	7
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	7
74-95-3	Dibromomethane	BRL	ug/Kg	7
75-27-4	Bromodichloromethane	BRL	ug/Kg	7
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	7
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	66
108-88-3	Toluene	BRL	ug/Kg	7
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	7
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	7
127-18-4	Tetrachloroethene	BRL	ug/Kg	7
142-28-9	1,3-Dichloropropane	BRL	ug/Kg	7
591-78-6	2-Hexanone	BRL	ug/Kg	66
124-48-1	Dibromochloromethane	BRL	ug/Kg	7
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/Kg	7
108-90-7	Chlorobenzene	BRL	ug/Kg	7
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/Kg	7
100-41-4	Ethylbenzene	BRL	ug/Kg	7



Field ID:

Geo-SB-91 (12')

62088-01

Project:

Woburn Wells G & H/2491-001

Laboratory ID: QC Batch ID:

VM1-1364-S

Client:

Geolnsight, Inc.

Sampled:

06-12-03

Container:

40 mL VOA Vial

Received:

06-16-03

Preservation:

NaHSO4 / Cool

Analyzed:

06-20-03

Matrix:

Soil

Dilution Factor:

1

% Moisture: 28

Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	7
95-47-6	ortho- Xylene	BRL	ug/Kg	7
100-42-5	Styrene	BRL	ug/Kg	7
75-25-2	Bromoform	BRL	ug/Kg	7
98-82-8	Isopropylbenzene	BRL	ug/Kg	7
108-86-1	Bromobenzene	BRL	ug/Kg	7
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	7
96-18-4	1,2,3-Trichloropropane	BRL	ug/Kg	7
103-65-1	n-Propylbenzene	BRL	ug/Kg	7
95-49-8	2-Chlorotoluene	BRL	ug/Kg	7
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/Kg	7
106-43-4	4-Chlorotoluene	BRL	ug/Kg	7
98-06-6	tert- Butylbenzene	BRL	ug/Kg	7
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/Kg	7
135-98-8	sec-Butylbenzene	BRL	ug/Kg	7
541-73-1	1,3-Dichlorobenzene	BRL	ug/Kg	7
99-87-6	4-Isopropyltoluene	BRL	ug/Kg	7.
106-46-7	1,4-Dichlorobenzene	BRL	ug/Kg	7
95-50-1	1,2-Dichlorobenzene	BRL	ug/Kg	7
104-51-8	n-Butylbenzene	BRL	ug/Kg	7
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/Kg	7
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/Kg	7
87-68-3	Hexachlorobutadiene	BRL	ug/Kg	7
91-20-3	Naphthalene	BRL	ug/Kg	7
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/Kg	7

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	107 %	80 - 120 %
1,2-Dichloroethane-d ₄	97 %	80 - 120 %
Toluene-d ₈	110 %	81 - 117 %
4-Bromofluorobenzene	96 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Results are reported on a dry weight basis.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Field ID:

Geo-SB-92 (16')

Project:

Woburn Wells G & H/2491-001

Client: Container: Preservation: Geolnsight, Inc. 40 mL VOA Vial Methanol / Cool

Matrix: % Moisture: Soil 28

Laboratory ID:

62088-02 VM1-1365-E

QC Batch ID: Sampled:

06-12-03

Received: Analyzed: 06-16-03 06-24-03

Dilution Factor: 1

1 of 2 Page:

CAS Number	Analyte	Concentration	Units	Reporting Lim
75-71-8	Dichlorodifluoromethane	BRL	ug/Kg	650
74-87-3	Chloromethane	BRL	ug/Kg	650
75-01-4	Vinyl Chloride	BRL	ug/Kg	650
74-83-9	Bromomethane	BRL	ug/Kg	650
75-00-3	Chloroethane	BRL	ug/Kg	650
75-69-4	Trichlorofluoromethane	BRL	ug/Kg	650
60-29-7	Diethyl Ether	BRL	ug/Kg	650
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	320
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/Kg	3,200
67-64-1	Acetone	BRL	ug/Kg	3,200
75-15-0	Carbon Disulfide	BRL	ug/Kg	3,200
75-09-2	Methylene Chloride	BRL	ug/Kg	1,300
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	320
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/Kg	320
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	320
590-20-7	2,2-Dichloropropane	BRL	ug/Kg	320
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	320
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	3,200
74-97-5	Bromochloromethane	BRL	ug/Kg	320
109-99-9	Tetrahydrofuran (THF)	BRL	ug/Kg	3,200
67-66-3	Chloroform	BRL	ug/Kg	320
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	320
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	320
563-58-6	1,1-Dichloropropene	BRL	ug/Kg	320
71-43-2	Benzene	BRL	ug/Kg	320
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	320
79-01-6	Trichloroethene	360	ug/Kg	320
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	320
74-95-3	Dibromomethane	BRL	ug/Kg	320
75-27-4	Bromodichloromethane	BRL	ug/Kg	320
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	320
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	3,200
108-88-3	Toluene	BRL	ug/Kg	320
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	320
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	320
127-18-4	Tetrachloroethene	BRL	ug/Kg	320
142-28-9	1,3-Dichloropropane	BRL	ug/Kg	320
591-78-6	2-Hexanone	BRL	ug/Kg	3,200
124-48-1	Dibromochloromethane	BRL	ug/Kg	320
106-93-4	1,2-Dibromoethane (EDB)	BRL -	ug/Kg	320
108-90-7	Chlorobenzene	BRL	ug/Kg	320
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/Kg	320
100-41-4	Ethylbenzene	BRL	ug/Kg	320



Geo-SB-92 (16') Field ID:

Woburn Wells G & H/2491-001

Geolnsight, Inc. Client: 40 mL VOA Vial Container:

Methanol / Cool Preservation:

Soil Matrix: % Moisture: 28

Project:

Laboratory ID: 62088-02

QC Batch ID: VM1-1365-E Sampled: 06-12-03

Received: 06-16-03 Analyzed: 06-24-03

Dilution Factor: 1 Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	320
95-47-6	ortho-Xylene	BRL	ug/Kg	320
100-42-5	Styrene	BRL	ug/Kg	320
75-25-2	Bromoform	BRL	ug/Kg	320
98-82-8	Isopropylbenzene	BRL	ug/Kg	320
108-86-1	Bromobenzene	BRL	ug/Kg	320
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	320
96-18-4	1,2,3-Trichloropropane	BRL	ug/Kg	320
103-65-1	n -Propylbenzene	BRL	ug/Kg	320
95-49-8	2-Chlorotoluene	BRL	ug/Kg	320
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/Kg	320
106-43-4	4-Chlorotoluene	BRL	ug/Kg	320
98-06-6	tert- Butylbenzene	BRL	ug/Kg	320
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/Kg	320
135-98-8	sec -Butylbenzene	BRL	ug/Kg	320
541-73-1	1,3-Dichlorobenzene	BRL	ug/Kg	320
99-87-6	4-Isopropyltoluene	BRL	ug/Kg	320
106-46-7	1,4-Dichlorobenzene	BRL	ug/Kg	320
95-50-1	1,2-Dichlorobenzene	BRL	ug/Kg	320
104-51-8	n -Butylbenzene	BRL	ug/Kg	320
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/Kg	320
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/Kg	320
87-68-3	Hexachlorobutadiene	BRL	ug/Kg	320
91-20-3	Naphthalene	BRL	ug/Kg	320
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/Kg	320

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	101 %	80 - 120 %
1,2-Dichloroethane-d ₄	84 %	80 - 120 %
Toluene-d ₈	113 %	81 - 117 %
4-Bromofluorobenzene	92 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Results are reported on a dry weight basis.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



62088-03

Laboratory ID:

Field ID: Geo-5 (16')

Project: Woburn Wells G & H/2491-001

QC Batch ID: VM1-1364-S Sampled: 06-12-03 Client: Geolnsight, Inc. Received: 06-16-03 Container: 40 mL VOA Vial Analyzed: 06-20-03 Preservation: NaHSO4 / Cool

Matrix: Soil Dilution Factor: 1 1 of 2 Page: % Moisture: 20

CAS Number	Analyte	Concentration	Units	Reporting Limit
75-71-8	Dichlorodifluoromethane	BRL	ug/Kg	12
74-87-3	Chloromethane	BRL	ug/Kg	12
75-01-4	Vinyl Chloride	BRL	ug/Kg	12
74-83-9	Bromomethane	BRL	ug/Kg	12
75-00-3	Chloroethane	BRL	ug/Kg	12
75-69-4	Trichlorofluoromethane	BRL	ug/Kg	12
60-29-7	Diethyl Ether	BRL	ug/Kg	12
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	6
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/Kg	58
67-64-1	Acetone	BRL	ug/Kg	230
75-15-0	Carbon Disulfide	BRL	ug/Kg	58
75-09-2	Methylene Chloride	BRL	ug/Kg	58
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/Kg	-6
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/Kg	6
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	6
590-20-7	2,2-Dichloropropane	BRL	ug/Kg	6
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	6
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	58
74-97-5	Bromochloromethane	BRL	ug/Kg	6
109-99-9	Tetrahydrofuran (THF)	BRL	ug/Kg	58
67-66-3	Chloroform	BRL	ug/Kg	6
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	6
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	6
563-58-6	1,1-Dichloropropene	BRL	ug/Kg	6
71-43-2	Benzene	BRL	ug/Kg	6
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	6
79-01-6	Trichloroethene	99	ug/Kg	6
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	6
74-95-3	Dibromomethane	BRL	ug/Kg	6
75-27-4	Bromodichloromethane	BRL	ug/Kg	6
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	6
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	58
108-88-3	Toluene	BRL	ug/Kg	6
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/Kg	6
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	6
127-18-4	Tetrachloroethene	6	ug/Kg	6
142-28-9	1,3-Dichloropropane	BRL	ug/Kg	6
591-78-6	2-Hexanone	BRL	ug/Kg	58
124-48-1	Dibromochloromethane	BRL	ug/Kg	6
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/Kg	6
108-90-7	Chlorobenzene	BRL	ug/Kg	6
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/Kg	6
100-41-4	Ethylbenzene	BRL	ug/Kg	6



Field ID:

Geo-5 (16')

Laboratory ID:

62088-03

Project:

Woburn Wells G & H/2491-001

QC Batch ID:

VM1-1364-S

Client:

GeoInsight, Inc.

Sampled:

06-12-03

Container:

40 mL VOA Vial

Received:

06-16-03

Preservation:

NaHSO4 / Cool

Analyzed:

06-20-03

Matrix:

Soil

Dilution Factor:

1

% Moisture: 20

Page:

2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	6
95-47-6	ortho-Xylene	BRL	ug/Kg	6
100-42-5	Styrene	BRL	ug/Kg	6
75-25-2	Bromoform	BRL	ug/Kg	6
98-82-8	Isopropylbenzene	BRL	ug/Kg	6
108-86-1	Bromobenzene	BRL	ug/Kg	6
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	6
96-18-4	1,2,3-Trichloropropane	BRL	ug/Kg	6
103-65-1	n-Propylbenzene	BRL	ug/Kg	6
95-49-8	2-Chlorotoluene	BRL	ug/Kg	6
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/Kg	6
106-43-4	4-Chlorotoluene	BRL	ug/Kg	6
98-06-6	tert- Butylbenzene	BRL	ug/Kg	6
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/Kg	6
135-98-8	sec -Butylbenzene	BRL	ug/Kg	6
541-73-1	1,3-Dichlorobenzene	BRL	ug/Kg	6
99-87-6	4-Isopropyltoluene	BRL	ug/Kg	6
106-46-7	1,4-Dichlorobenzene	BRL	ug/Kg	6
95-50-1	1,2-Dichlorobenzene	BRL	ug/Kg	6
104-51-8	n-Butylbenzene	BRL	ug/Kg	6
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/Kg	6
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/Kg	6
87-68-3	Hexachlorobutadiene	BRL	ug/Kg	6
91-20-3	Naphthalene	BRL	ug/Kg	6
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/Kg	6

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	88 %	80 - 120 %	
1,2-Dichloroethane-d ₄	96 %	80 - 120 %	
Toluene-d ₈	108 %	81 - 117 %	
4-Bromofluorobenzene	93 %	74 - 121 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Results are reported on a dry weight basis.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.





June 25, 2003

GROUNDWATER ANALYTICAL 228 Main Street Buzzards Bay, MA 02532-1200

Attention: Mr. Eric Jensen

EAS Project Number: 03060340 Location Collected: Soil Sample

Copies of this report and the supporting computer stored data are retained in our files in the event they are required for future reference.

Any sample submitted to our laboratory will be retained for a maximum of thirty (30) days from receipt of the report.

All analytical data, unless otherwise specified, is reported on a wet weight (as received) basis.

Our laboratory is a multi-state Certified Public Health Laboratory, offering a full range of analytical services that include:

Water and Wastewater Analysis Hazardous Waste Analysis (RCRA) Full Priority Pollutant Analysis Drinking Water Analysis

Gregory C. Lawrence Laboratory Director

encl.

GROUNDWATER ANALYTICAL

Location Collected: Soil Sample Date Sample Collected: 06/12/03 Sample Description: GEO-SB-91 (12') EAS Sample Number: 03060340-01 LIMS ID Number: AE06691

Date Sample Received: 06/23/03 Client Project Number: 62088

		Detection		Analysis
Parameter	Data	Limit	Units	Date
Total Organic Carbon, Solid	BDL	250	mg/kg	06/24/03

BDL = Below Detection Limit

GROUNDWATER ANALYTICAL

Location Collected: Soil Sample Date Sample Collected: 06/12/03 Sample Description: GEO-SB-92 (16') EAS Sample Number: 03060340-02

LIMS ID Number: AE06692 Date Sample Received: 06/23/03 Client Project Number: 62088

	Detection			Analysis
Parameter	Data	Limit	Units	Date
Total Organic Carbon, Solid	BDL	250	mg/kg	06/24/03

BDL = Below Detection Limit

GROUNDWATER ANALYTICAL

Location Collected: Soil Sample Date Sample Collected: 06/12/03 Sample Description: GEO-5 (16') EAS Sample Number: 03060340-03 LIMS ID Number: AE06693 Date Sample Received: 06/23/03 Client Project Number: 62088

	Detection			Analysis	
Parameter	Data	Limit	Units	Date	
Total Organic Carbon, Solid	\mathtt{BDL}	250	mg/kg	06/24/03	

BDL - Below Detection Limit



EAS Project Number: 03060340 Location Collected: Soil Sample

EAS Certifications:

Connecticut Certified Laboratory Number: PH 0558

Massachusetts Certified Laboratory Number: M-CT020

Maine Certified Laboratory Number: CT 020

New York Certified Laboratory Number: 10916

Rhode Island Certified Number: 139

The enclosed analyses were conducted in accordance with:

- 1. APHA Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992
- 2. Clean Water Act, List of Approved Test Procedures, 40 CFR
- 3. EPA Test Methods for the Evaluation of solid Waste, SW-846, 3rd Edition, January 1998

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EAS Laboratories, Inc., 105 Commercial Street, Watertown, CT 06795. MA Certification M-CT020. EAS Laboratories is NELAC accredited.



Project Narrative

Project: Client: Woburn Wells G & H/2491-001

Geolnsight, Inc.

Lab ID:

62088

Received: 06-16-03 19:10

A. Documentation and Client Communication

The following documentation discrepancies, and client changes or amendments were noted for this project:

1. No discrepancies, changes, or amendments were noted.

B. Method Non-Conformances

The following method non-conformances were noted for this project:

1. No method non-conformances were noted.

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Quality Assurance/Quality Control

A. Program Overview

Groundwater Analytical conducts an active Quality Assurance program to ensure the production of high quality, valid data. This program closely follows the guidance provided by *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, US EPA QAMS-005/80 (1980), and *Test Methods for Evaluating Solid Waste*, US EPA, SW-846, Update III (1996).

Quality Control protocols include written Standard Operating Procedures (SOPs) developed for each analytical method. SOPs are derived from US EPA methodologies and other established references. Standards are prepared from commercially obtained reference materials of certified purity, and documented for traceability.

Quality Assessment protocols for most organic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. All samples, standards, blanks, laboratory control samples, matrix spikes and sample duplicates are spiked with internal standards and surrogate compounds. All instrument sequences begin with an initial calibration verification standard and a blank; and excepting GC/MS sequences, all sequences close with a continuing calibration standard. GC/MS systems are tuned to appropriate ion abundance criteria daily, or for each 12 hour operating period, whichever is more frequent.

Quality Assessment protocols for most inorganic analyses include a minimum of one laboratory control sample, one method blank, one matrix spike sample, and one sample duplicate for each sample preparation batch. Standard curves are derived from one reagent blank and four concentration levels. Curve validity is verified by standard recoveries within plus or minus ten percent of the curve.

B. Definitions

Batches are used as the basic unit for Quality Assessment. A Batch is defined as twenty or fewer samples of the same matrix which are prepared together for the same analysis, using the same lots of reagents and the same techniques or manipulations, all within the same continuum of time, up to but not exceeding 24 hours.

Laboratory Control Samples are used to assess the accuracy of the analytical method. A Laboratory Control Sample consists of reagent water or sodium sulfate spiked with a group of target analytes representative of the method analytes. Accuracy is defined as the degree of agreement of the measured value with the true or expected value. Perent Recoveries for the Laboratory Control Samples are calculated to assess accuracy.

Method Blanks are used to assess the level of contamination present in the analytical system. Method Blanks consist of reagent water or an aliquot of sodium sulfate. Method Blanks are taken through all the appropriate steps of an analytical method. Sample data reported is not corrected for blank contamination.

Surrogate Compounds are used to assess the effectiveness of an analytical method in dealing with each sample matrix. Surrogate Compounds are organic compounds which are similar to the target analytes of interest in chemical behavior, but which are not normally found in environmental samples. Percent Recoveries are calculated for each Surrogate Compound.



Quality Control Report Laboratory Control Sample

Category: EPA Method 8260B QC Batch ID: VM1-1364-SL

Matrix: Soil Units: ug/Kg

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	50	41	82 %	70 - 130 %
71-43-2	Benzene	50	49	98 %	70 - 130 %
79-01-6	Trichloroethene	50	54	109 %	70 - 130 %
108-88-3	Toluene	50	51	101 %	70 - 130 %
108-90-7	Chlorobenzene	50	49	99 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	90 %	80 - 120 %
1,2-Dichloroethane-d ₄	95 %	80 - 120 %
Toluene-d ₈	107 %	81 - 117 %
4-Bromofluorobenzene	91 %	74 - 121 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, Report Notations:

or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: EPA Method 8260B QC Batch ID: VM1-1364-SB

Matrix: Soil Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/Kg	10
74-87-3	Chloromethane	BRL	ug/Kg	10
75-01-4	Vinyl Chloride	BRL	ug/Kg	10
74-83-9	Bromomethane	BRL	ug/Kg	10
75-00-3	Chloroethane	BRL	ug/Kg	10
75-69-4	Trichlorofluoromethane	BRL	ug/Kg	10
60-29-7	Diethyl Ether	BRL	ug/Kg	10-
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	5
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/Kg	50
67-64-1	Acetone	BRL	ug/Kg	200
75-15-0	Carbon Disulfide	BRL	ug/Kg	50
75-09-2	Methylene Chloride	BRL	ug/Kg	50
156-60-5	trans- 1,2-Dichloroethene	BRL	ug/Kg	5
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/Kg	5
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	5
590-20-7	2,2-Dichloropropane	BRL	ug/Kg	5
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	5
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	50
74-97-5	Bromochloromethane	BRL	ug/Kg	5
109-99-9	Tetrahydrofuran (THF)	BRL	ug/Kg	50
67-66-3	Chloroform	BRL	ug/Kg	5
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	5
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	5
563-58-6	1,1-Dichloropropene	BRL	ug/Kg	5
71-43-2	Benzene	BRL	ug/Kg	5
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	5
79-01-6	Trichloroethene	BRL	ug/Kg	5
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	5
74-95-3	Dibromomethane	BRL	ug/Kg	5
75-27-4	Bromodichloromethane	BRL	ug/Kg	5
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	5
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	50
108-88-3	Toluene	BRL	ug/Kg	5
10061-02-6	trans- 1,3-Dichloropropene	BRL	ug/Kg	5
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	5
127-18-4	Tetrachloroethene	BRL	ug/Kg	5
142-28-9	1,3-Dichloropropane	BRL	ug/Kg	5
591-78-6	2-Hexanone	BRL	ug/Kg	50
124-48-1	Dibromochloromethane	BRL	ug/Kg	5
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/Kg	5
108-90-7	Chlorobenzene	BRL	ug/Kg	5
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/Kg	5
100-41-4	Ethylbenzene	BRL	ug/Kg	5



Quality Control Report Method Blank

Category: EPA Method 8260B

QC Batch ID: VM1-1364-SB

Matrix: Soil Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limit
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	5
95-47-6	ortho-Xylene	BRL	ug/Kg	5
100-42-5	Styrene	BRL	ug/Kg	5
75-25-2	Bromoform	BRL	ug/Kg	5
98-82-8	Isopropylbenzene	BRL	ug/Kg	5
108-86-1	Bromobenzene	BRL	ug/Kg	5
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	5
96-18-4	1,2,3-Trichloropropane	BRL	ug/Kg	5
103-65-1	n-Propylbenzene	BRL	ug/Kg	5
95-49-8	2-Chlorotoluene	BRL	ug/Kg	5
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/Kg	5
106-43-4	4-Chlorotoluene	BRL	ug/Kg	5
98-06-6	tert- Butylbenzene	BRL	ug/Kg	5
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/Kg	5
135-98-8	sec-Butylbenzene	BRL	ug/Kg	- 5
541-73-1	1,3-Dichlorobenzene	BRL	ug/Kg	5
99-87-6	4-Isopropyltoluene	BRL	ug/Kg	5
106-46-7	1,4-Dichlorobenzene	BRL	ug/Kg	5
95-50-1	1,2-Dichlorobenzene	BRL	ug/Kg	5
104-51-8	n -Butylbenzene	BRL	ug/Kg	5
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/Kg	5
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/Kg	5
87-68-3	Hexachlorobutadiene	BRL	ug/Kg	5
91-20-3	Naphthalene	BRL	ug/Kg	5
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/Kg	5

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	96 %	80 - 120 %
1,2-Dichloroethane-d ₄	80 %	80 - 120 %
Toluene-d ₈	100 %	81 - 117 %
4-Bromofluorobenzene	94 %	74 - 121 %

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Results are reported on a dry weight basis.

Report Notations:

Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Quality Control Report Laboratory Control Sample

Category: EPA Method 8260B

QC Batch ID: VM1-1365-EL

Matrix: Soil Units: ug/Kg

CAS Number	Analyte	Spiked	Measured	Recovery	QC Limits
75-35-4	1,1-Dichloroethene	2,500	2,300	91 %	70 - 130 %
71-43-2	Benzene	2,500	2,600	106 %	70 - 130 %
79-01-6	Trichloroethene	2,500	2,800	112 %	70 - 130 %
108-88-3	Toluene	2,500	2,600	105 %	70 - 130 %
108-90-7	Chlorobenzene	2,500	2,400	97 %	70 - 130 %

QC Surrogate Compounds	Recovery	QC Limits
Dibromofluoromethane	91 %	80 - 120 %
1,2-Dichloroethane-d ₄	85 %	80 - 120 %
Toluene-d ₈	107 %	81 - 117 %
4-Bromofluorobenzene	92 %	74 - 121 %

Method Reference: Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996).

Report Notations: All calculations performed prior to rounding. Quality Control Limits are defined by the methodology, or alternatively based upon the historical average recovery plus or minus three standard deviation units.



Quality Control Report Method Blank

Category: EPA Method 8260B

QC Batch ID: VM1-1365-EB Matrix: Soil

Page: 1 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
75-71-8	Dichlorodifluoromethane	BRL	ug/Kg	500
74-87-3	Chloromethane	BRL	ug/Kg	500
75-01-4	Vinyl Chloride	BRL	ug/Kg	500
74-83-9	Bromomethane	BRL	ug/Kg	500
75-00-3	Chloroethane	BRL	ug/Kg	500
75-69-4	Trichlorofluoromethane	BRL	ug/Kg	500
60-29-7	Diethyl Ether	BRL	ug/Kg	500
75-35-4	1,1-Dichloroethene	BRL	ug/Kg	250
76-13-1	1,1,2-Trichlorotrifluoroethane	BRL	ug/Kg	2,500
67-64-1	Acetone	BRL	ug/Kg	2,500
75-15-0	Carbon Disulfide	BRL	ug/Kg	2,500
75-09-2	Methylene Chloride	BRL	ug/Kg	1,000
156-60-5	trans-1,2-Dichloroethene	BRL	ug/Kg	250
1634-04-4	Methyl tert-butyl Ether (MTBE)	BRL	ug/Kg	250
75-34-3	1,1-Dichloroethane	BRL	ug/Kg	250
590-20-7	2,2-Dichloropropane	BRL	ug/Kg	250
156-59-2	cis-1,2-Dichloroethene	BRL	ug/Kg	250
78-93-3	2-Butanone (MEK)	BRL	ug/Kg	2,500
74-97-5	Bromochloromethane	BRL	ug/Kg	250
109-99-9	Tetrahydrofuran (THF)	BRL	ug/Kg	2,500
67-66-3	Chloroform	BRL	ug/Kg	250
71-55-6	1,1,1-Trichloroethane	BRL	ug/Kg	250
56-23-5	Carbon Tetrachloride	BRL	ug/Kg	250
563-58-6	1,1-Dichloropropene	BRL	ug/Kg	250
71-43-2	Benzene	BRL	ug/Kg	250
107-06-2	1,2-Dichloroethane	BRL	ug/Kg	250
79-01-6	Trichloroethene	BRL	ug/Kg	250
78-87-5	1,2-Dichloropropane	BRL	ug/Kg	250
74-95-3	Dibromomethane	BRL	ug/Kg	250
75-27-4	Bromodichloromethane	BRL	ug/Kg	250
10061-01-5	cis-1,3-Dichloropropene	BRL	ug/Kg	250
108-10-1	4-Methyl-2-Pentanone (MIBK)	BRL	ug/Kg	2,500
108-88-3	Toluene	BRL	ug/Kg	250
10061-02-6	trans-1,3-Dichloropropene	BRL	ug/Kg	250
79-00-5	1,1,2-Trichloroethane	BRL	ug/Kg	250
127-18-4	Tetrachloroethene	BRL	ug/Kg	250
142-28-9	1,3-Dichloropropane	BRL	ug/Kg	250
591-78-6	2-Hexanone	BRL	ug/Kg	2,500
124-48-1	Dibromochloromethane	BRL	ug/Kg	250
106-93-4	1,2-Dibromoethane (EDB)	BRL	ug/Kg	250
108-90-7	Chlorobenzene	BRL	ug/Kg	250
630-20-6	1,1,1,2-Tetrachloroethane	BRL	ug/Kg	
100-41-4	Ethylbenzene	BRL	ug/Kg	250
100-41-4	Luiyibenzene	DKL	ng/kg	250



Quality Control Report Method Blank

Category: EPA Method 8260B QC Batch ID: VM1-1365-EB

> Matrix: Soil Page: 2 of 2

CAS Number	Analyte	Concentration	Units	Reporting Limi
108-38-3/106-42-3	meta- Xylene and para- Xylene	BRL	ug/Kg	250
95-47-6	ortho- Xylene	BRL	ug/Kg	250
100-42-5	Styrene	BRL	ug/Kg	250
75-25-2	Bromoform	BRL	ug/Kg	250
98-82-8	Isopropylbenzene	BRL	ug/Kg	250
108-86-1	Bromobenzene	BRL	ug/Kg	250
79-34-5	1,1,2,2-Tetrachloroethane	BRL	ug/Kg	250
96-18-4	1,2,3-Trichloropropane	BRL	ug/Kg	250
103-65-1	n-Propylbenzene	BRL	ug/Kg	250
95-49-8	2-Chlorotoluene	BRL	ug/Kg	250
108-67-8	1,3,5-Trimethylbenzene	BRL	ug/Kg	250
106-43-4	4-Chlorotoluene	BRL	ug/Kg	250
98-06-6	tert- Butylbenzene	BRL	ug/Kg	250
95-63-6	1,2,4-Trimethylbenzene	BRL	ug/Kg	250
135-98-8	sec-Butylbenzene	BRL	ug/Kg	250
541-73-1	1,3-Dichlorobenzene	BRL	ug/Kg	250
99-87-6	4-Isopropyltoluene	BRL	ug/Kg	250
106-46-7	1,4-Dichlorobenzene	BRL	ug/Kg	250
95-50-1	1,2-Dichlorobenzene	BRL	ug/Kg	250
104-51-8	n-Butylbenzene	BRL	ug/Kg	250
96-12-8	1,2-Dibromo-3-chloropropane	BRL	ug/Kg	250
120-82-1	1,2,4-Trichlorobenzene	BRL	ug/Kg	250
87-68-3	Hexachlorobutadiene	BRL	ug/Kg	250
91-20-3	Naphthalene	BRL	ug/Kg	250
87-61-6	1,2,3-Trichlorobenzene	BRL	ug/Kg	250

QC Surrogate Compounds	Recovery	QC Limits	
Dibromofluoromethane	89 %	80 - 120 %	
1,2-Dichloroethane-d ₄	86 %	80 - 120 %	
Toluene-d ₈	106 %	81 - 117 %	
4-Bromofluorobenzene	92 %	74 - 121 %	

Method Reference:

Test Methods for Evaluating Solid Waste, US EPA, SW-846, Third Edition, Update III (1996). Analyte list as specified in Tables 6 and 7 of the method, and additional analytes as specified by MA DEP Method 1 Standards (310 C.M.R. 40.0973) and recommended by NH DES for initial waste site investigations, effective 12/1/97. Results are reported on a dry weight basis.

Report Notations:

RL Indicates concentration, if any, is below reporting limit for analyte. Reporting limit is the lowest concentration that can be reliably quantified under routine laboratory operating conditions. Reporting limits are adjusted for sample dilution, percent moisture and sample size.



Certifications and Approvals

Groundwater Analytical maintains environmental laboratory certification in a variety of states. Copies of our current certificates may be obtained from our website:

http://www.groundwateranalytical.com/qualifications.htm

CONNECTICUT, Department of Health Services, PH-0586

Categories: Potable Water, Wastewater, Solid Waste and Soil

http://www.dph.state.ct.us/BRS/Environmental Lab/OutStateLabList.htm

FLORIDA, Department of Health, Bureau of Laboratories, E87643

Categories: SDWA, CWA, RCRA/CERCLA http://www.floridadep.org/labs/qa/dohforms.htm

MAINE, Department of Human Services, MA103

Categories: Drinking Water and Wastewater

http://www.state.me.us/dhs/eng/water/Compliance.htm

MASSACHUSETTS, Department of Environmental Protection, M-MA-103

Categories: Potable Water and Non-Potable Water http://www.state.ma.us/dep/bspt/wes/files/certlabs.pdf

NEW HAMPSHIRE, Department of Environmental Services, 202703

Categories: Drinking Water and Wastewater

http://www.des.state.nh.us/asp/NHELAP/labsview.asp

NEW YORK, Department of Health, 11754

Categories: Potable Water, Non-Potable Water and Solid Waste

http://www.wadsworth.org/labcert/elap/comm.html

PENNSYLVANIA, Department of Environmental Protection, 68-665

Environmental Laboratory Registration (Non-drinking water and Non-wastewater) http://www.dep.state.pa.us/Labs/Registered/

RHODE ISLAND, Department of Health, 54

Categories: Surface Water, Air, Wastewater, Potable Water, Sewage

http://www.healthri.org/labs/labsCT MA.htm

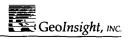
U.S. Department of Agriculture, Soil Permit, S-53921

Foreign soil import permit

VERMONT, Department of Environmental Conservation, Water Supply Division

Category: Drinking Water

http://www.vermontdrinkingwater.org/wsops/labtable.PDF



APPENDIX F

Laboratory Reports: Grain Size

Geotechnical Test Report

60 Olympia Project Woburn, MA

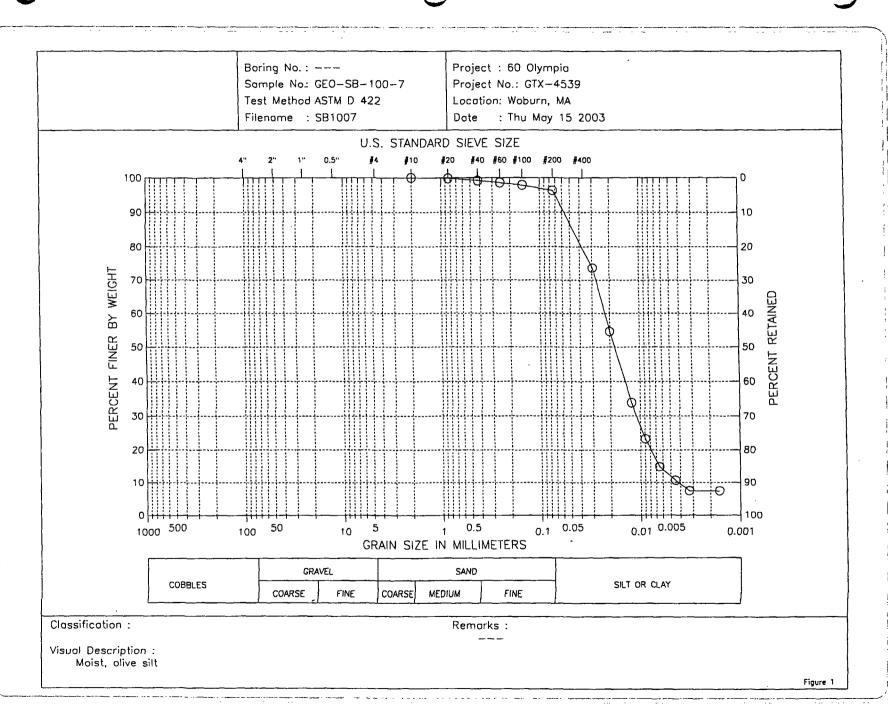
Prepared for:

GeoInsight Westford, MA

Prepared by:



May 15, 2003



Thu May 15 09:03:16 2003

Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : 60 Olympia

Project No. : GTX-4539 Boring No. : ---Sample No. : GEO-SB-100-7 Depth : 7 ft

Test Date : 05/14/03 Test Method : ASTM D 422 Filename : SB1007 Elevation : ---Tested by : njh Checked by : jdt

Location : Woburn, MA Soil Description : Moist, olive silt

Remarks : ---

HYDROMETER

Hydrometer ID : 127630

Weight of air-dried soil = 45.07 gm

Specific Gravity

= 2.7

Hydroscopic Moisture Content : Weight of Wet Soil = 0 gm

Weight of Dry Soil = 0 gm

Moisture Content = 0

Elapsed Time (min)	Reading	Temperature (deg. C)	Corrected Reading	Particle Size (mm)	Percent Piner (%)	Adjusted Particle Size
2.00	40.00	20.50	34.75	0.030	74	0.030
5.00	31,00	20.50	25,75	0.020	55	0.020
15.00	21.00	21.00	16.00	0.012	34	0.012
30.00	16.00	21.00	11.00	0.009	23	0.009
60.00	12.00	21.00	7.00	0.006	15	0.006
127.00	10.00	21.50	5,00	0.004	11	0.004
240.00	8.50	22.00	3.50	0.003	7	0.003
980.00	8.50	21.50	3.50	0.002	7	0.002

Sieve	01 O		FINE SIEVE SET	Cumulative	D
Mesh	Sieve Op Inches	Millimeters	Weight Retained (gm)	Weight Retained (gm)	Percent Finer (%)
#10	0.079	2.00	0.00	0.00	100
#20	0.033	0,84	0.08	0.08	100
#40	0.017	0,42	0.30	0.38	99
#60	0.010	0.25	0.26	0.64	99
#100	0.006	0.15	0.31	0.95	98
#200	0.003	0,07	0.73	1.68	96
Pan			45.07	46.75	0

Total Dry Weight of Sample = 149.48

D85 : 0.0467 mm

D60 : 0.0223 mm

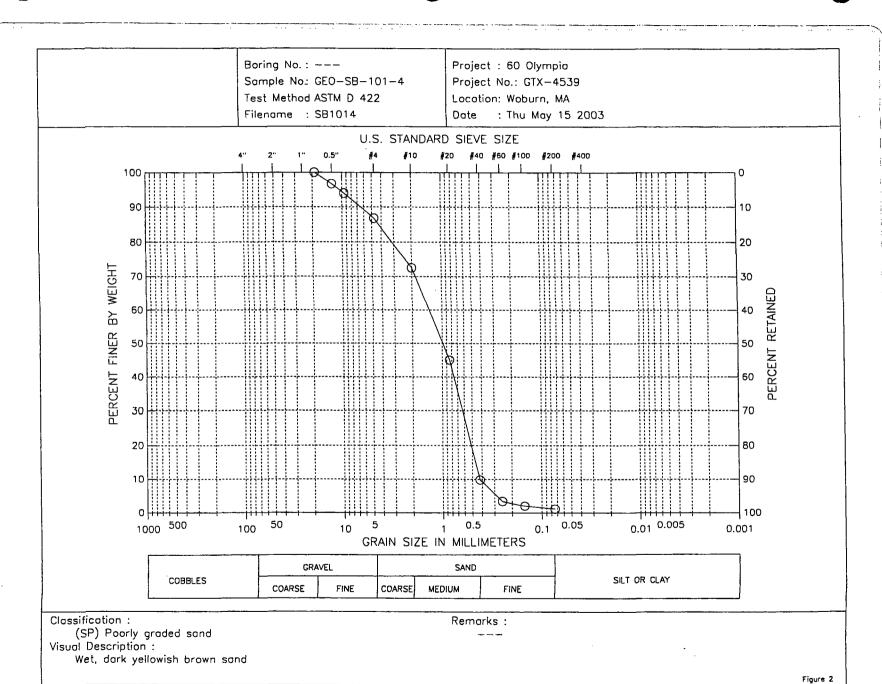
D50 : 0.0180 mm D30 : 0.0109 mm

D15 : 0.0065 mm

D10 : 0.0042 mm

Soil Classification

ASTM Group Symbol : N/A ASTM Group Name : N/A AASHTO Group Symbol : A-4(0) AASHTO Group Name : Silty Soils



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Page: 1

GEOTECHNICAL LABORATORY TEST DATA

Project : 60 Olympia

Boring No. : ---

Project No. : GTX-4539

Depth : 4 ft

Test Date : 05/09/03

Test Method : ASTM D 422

Filename : SB1014 Elevation : ---Tested by : njh

Checked by ; jdt

Sample No. : GEO-SB-101-4 Location : Woburn, MA

Soil Description : Wet, dark yellowish brown sand

Remarks : ---

Sieve	Sieve O	penings	FINE SIEVE SET Weight	Cumulative	Percent
Mesh	Inches	Millimeters	Retained (gm)	Weight Retained (gm)	Finer (%)
0.75"	0.748	19,00	0.00	0.00	100
0.5*	0.500	12.70	3.95	3.95	97
0.375	0.374	9.51	3.24	7.19	94
#4	0.187	4.75	8.66	15.85	87
#10	0.079	2.00	17.06	32,91	73
#20	0.033	0.84	33.07	65.98	45
#4 G	0.017	0.42	42.23	108.21	10
#60	0.010	0.25	7.60	115.81	3
#100	0.006	0.15	1.73	117.54	2
#200	0.003	0.07	1.07	118.61	1
Рап			1.36	119.97	0

Total Dry Weight of Sample = 128.16

D85 : 4.2604 mm

D60 : 1.3474 mm

D50 : 0.9840 mm D30 : 0.6256 mm

D15 : 0.4653 mm D10 : 0.4216 mm

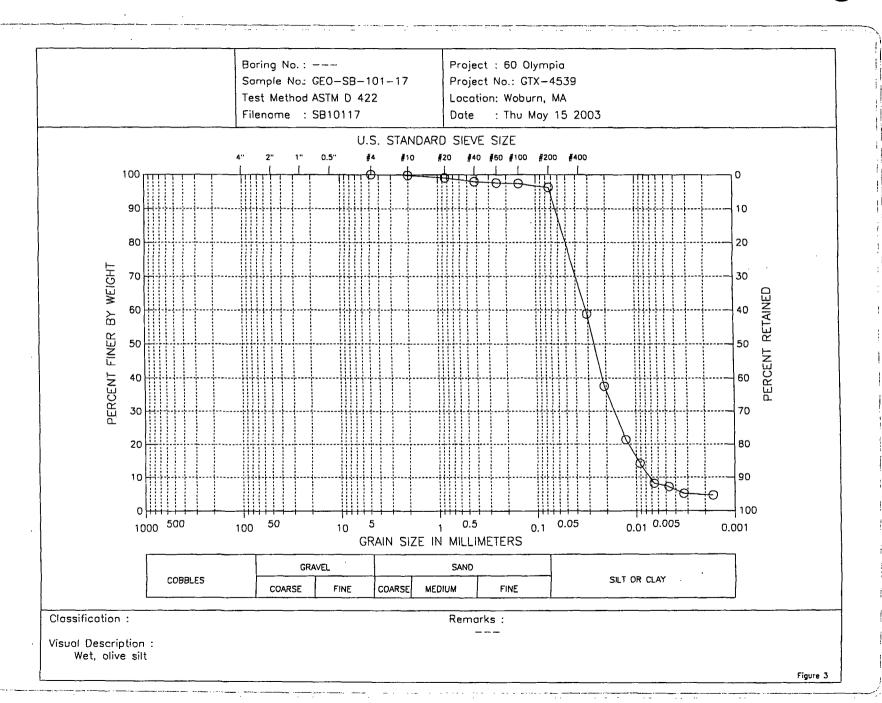
Soil Classification

ASTM Group Symbol

ASTM Group Name : Poorly graded sand

AASHTO Group Symbol : A-1-b(0)

AASHTO Group Name : Stone Pragments, Gravel and Sand



Thu May 15 09:03:17 2003

Page: 1

GEOTECHNICAL LABORATORY TEST DATA

Project : 60 Olympia

Project No. : GTX-4539

Boring No. : ---

Sample No. : GEO-SB-101-17

Location : Woburn, MA

Soil Description : Wet, olive silt

Remarks : ---

Filename : SB10117 Elevation : ---Tested by : njh

Checked by : jdt

HYDROMETER

Test Date : 05/14/03

Test Method : ASTM D 422

Depth : 17 ft

Hydrometer ID : 127630

Weight of air-dried soil = 46.99 gm

Specific Gravity

= 2.7

Hydroscopic Moisture Content : Weight of Wet Soil = 0 gm

Weight of Dry Soil = 0 gm

Moisture Content = 0

Elapsed Time (min)	Reading	Temperature (deg. C)	Corrected Reading	Particle Size (mm)	Percent Finer (%)	Adjusted Particle Size
2.00	34.00	21,00	29.00	0.031	59	0.031
5.00	23.50	21,00	18.50	0.021	38	0.021
15.00	15.50	21.00	10.50	0.013	21	0.013
30.00	12.00	21,00	7.00	0.009	14	0.009
60.00	9.00	21.00	4.00	0.007	8	0.007
120.00	8.50	21.00	3.50	0.005	7	0.005
240.00	7.50	22.00	2.50	0.003	5	0.003
976.00	7.50	20.50	2.25	0.002	5	0.002

Sieve	Sieve O	-	INE SIEVE SET Weight	Cumulative	Percent
Mesh	Inches	Millimeters	Retained (gm)	Weight Retained (gm)	Finer
#4	0.187	4.75	0.00	0.00	100
#10	0.079	2.00	0.09	0.09	100
#20	0.033	0.84	0.36	0.45	99
#40	0.017	0,42	0,53	О.9В	98
#60	0.010	0.25	0.19	1.17	98
#100	0.006	0.15	0,09	1.26	97
#200	0.003	0.07	0,55	1.81	96
Draw			46.00	40.00	0

Total Dry Weight of Sample = 155.51

D85 : 0.0568 mm

D60 : 0.0316 mm

D50 : 0.0262 mm

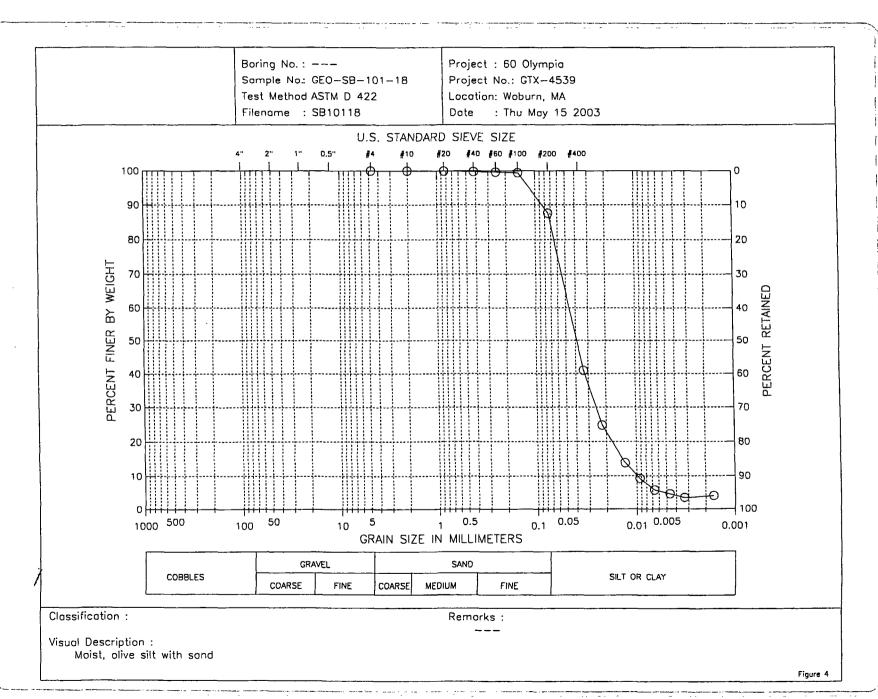
D30 : 0.0166 mm

D15 : 0.0095 mm D10 : 0.0073 mm

Soil Classification

ASTM Group Symbol ASTM Group Name : N/A AASHTO Group Symbol : A-4(0)

AASHTO Group Name : Silty Soils



Thu May 15 09:03:17 2003

Page: 1

GEOTECHNICAL LABORATORY TEST DATA

Project : 60 Olympia

Project No. : GTX-4539 Boring No. : --- Depth : 18 ft

Test Date: 05/14/03 Test Method: ASTM D 422 Filename : SB10118 Elevation : ---Tested by : njh Checked by : jdt

Sample No. : GEO-SB-101-18 Location : Woburn, MA

Soil Description : Moist, olive silt with sand

Remarks : ---

HYDROMETER

Hydrometer ID : 127630

Weight of air-dried soil = 37.66 gm

Specific Gravity

= 2.7

Hydroscopic Moisture Content : Weight of Wet Soil = 0 gm

Weight of Dry Soil = 0 gm

Moisture Content = 0

Elapsed Time (min)	Reading	Temperature (deg. C)	Corrected Reading	Particle Size (mm)	Percent Finer (%)	Adjusted Particle Size
						~
2.00	23.00	20.50	17.75	0,033	41	0.033
5.00	16.00	20.50	10.75	0.022	25	0.022
15,00	11.00	21.00	6.00	0.013	14	0.013
30.00	9.00	21.00	4.00	0.009	9	0.009
60.00	7.50	21.00	2,50	0.007	6	0.007
122.00	7.00	21.50	2.00	0.005	5	0.005
240.00	6.50	22.00	1.50	0.003	3	0.003
979.00	7.00	20.50	1.75	0,002	4	0.002

Sieve	Sieve O	penings	FINE SIEVE SET Weight	Cumulative	Percent
Mesh	Inches	Millimeters	Retained (gm)	Weight Retained (gm)	Finer (%)
#4	0.187	4.75	0.00	0.00	100
#10	0.079	2.00	0.00	0.00	100
#20	0.033	0.84	0.04	0.04	100
#40	0.017	0.42	0.07	0.11	100
#60	0.010	0.25	0.05	0.16	100
#100	0.006	0.15	0.08	0.24	99
#200	0.003	0.07	5.10	5.34	88
Pan			37.66	43.00	0

Total Dry Weight of Sample = 160,99

D85 : 0.0708 mm

D60 : D.D463 mm

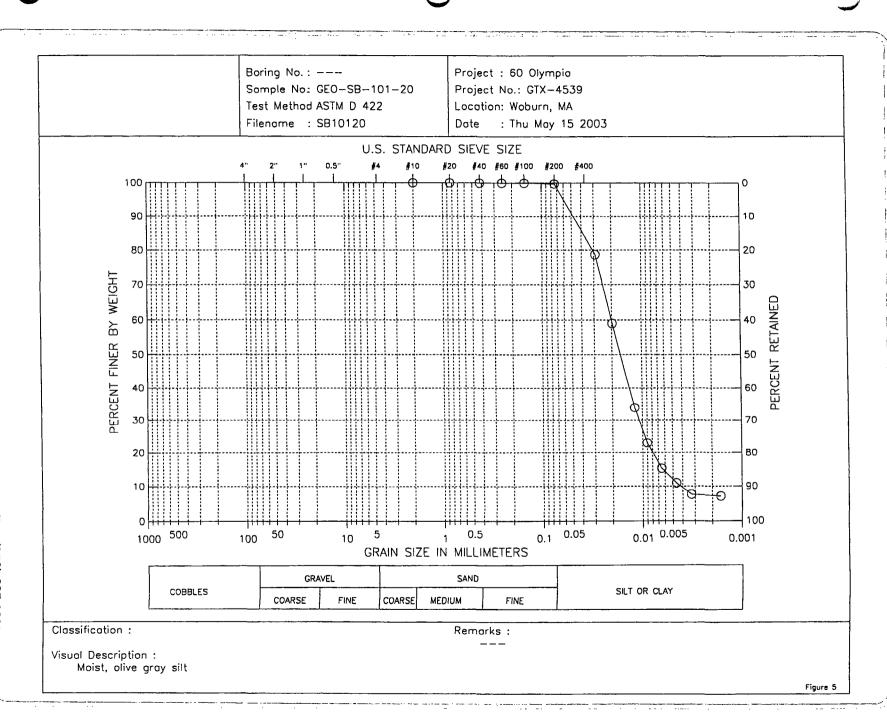
D50 : 0.0390 mm

D30 : 0.0253 mm D15 : 0.0138 mm

D10 : 0.0099 mm

Soil Classification

ASTM Group Symbol : N/A
ASTM Group Name : N/A
AASHTO Group Symbol : A-4(0)
AASHTO Group Name : Silty Soila



Thu May 15 09:03:18 2003

Page: 1

GEOTECHNICAL LABORATORY TEST DATA

Project : 60 Olympia

Project No. : GTX-4539

Boring No. : ---

Depth : 20 ft

Test Date : 05/14/03 Test Method : ASTM D 422 Filename : SB10120 Elevation : ---Tested by : njh Checked by : jdt

Sample No. : GEO-SB-101-20 Location : Woburn, MA

Soil Description : Moist, olive gray silt

Remarks : ---

HYDROMETER

Hydrometer ID : 127630

Weight of air-dried soil = 45.22 gm

Specific Gravity

= 2.7

Hydroscopic Moisture Content :

Weight of Wet Soil = 0 gm Weight of Dry Soil = 0 gm

Moisture Content = 0

Elapsed Time (min)	Reading	Temperature (deg. C)	Corrected Reading	Particle Size (mm)	Percent Finer (%)	Adjusted Particle Size
2.00	41.00	21.00	36.00	0.029	79	0.029
5.00	32.00	21.00	27.00	0.029	59	0.020
	-	= :				****
16.00	20.50	21.00	15.50	0.012	34	0.012
30.00	15.50	21.00	10.50	0.009	23	0.009
60.00	12.00	21.00	7.00	0.006	15	0.006
120.00	10.00	21.50	5.00	0.005	11	0.005
240.00	8.50	22.00	3.50	0.003	8	0.003
977.00	8.50	20.50	3.25	0.002	7	0.002

			FINE SIEVE SET		
Sieve	Sieve O	penings	Weight	Cumulative	Percent
Mesh	Inches	Millimeters	Retained (gm)	Weight Retained (gm)	Finer
#10	0.079	2.00	0.00	0.00	100
#20	0.033	0.84	0.01	0.01	100
#40	0.017	0.42	0.01	0.02	100
#60	0.010	0.25	0.01	0.03	100
#100	0.006	0.15	0.01	0.04	100
#200	0.003	0.07	0.09	0.13	100
Pan			45.22	45.35	0

Total Dry Weight of Sample = 163.5

D85 : 0.0385 mm D60 : 0.0201 mm

D50 : 0.0165 mm D30 : 0.0108 mm

D15 : 0.0063 mm D10 : 0.0042 mm

Soil Classification

ASTM Group Symbol ASTM Group Name : N/A AASHTO Group Symbol : A-4(0) AASHTO Group Name : Silty Soils

Geotechnical Test Report

60 Olympia Project Woburn, MA

Prepared for:

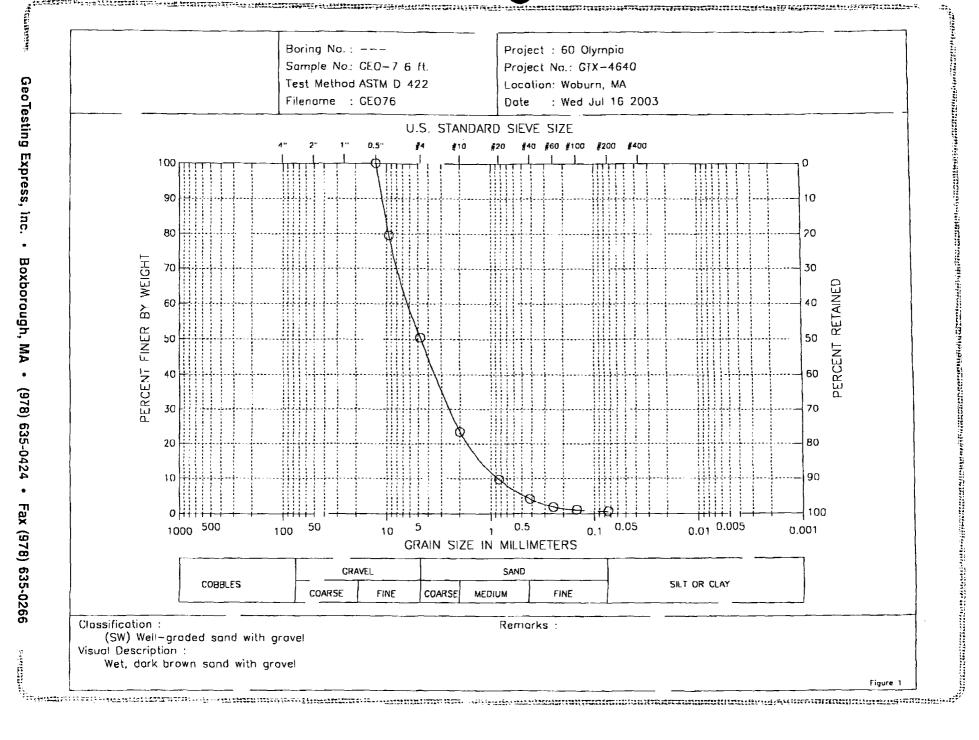
Geolnsight

Westford, MA

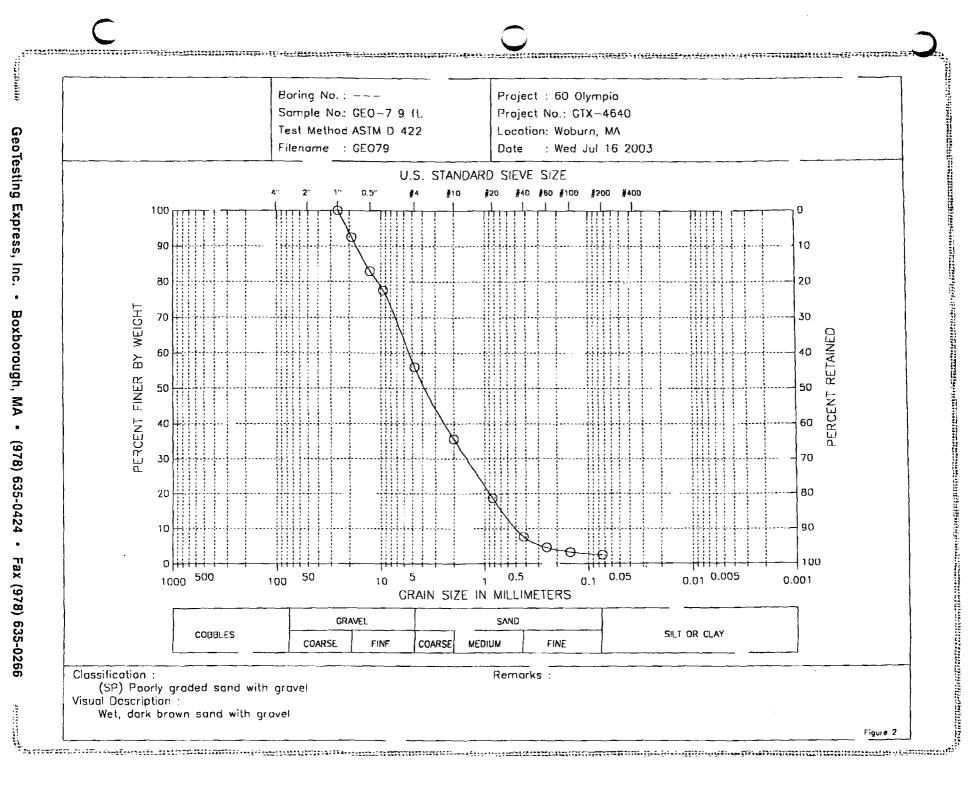
Prepared by:



July 16, 2003



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	39:10:52 2003					Page: 1
		GE	OTECHNICAL LA	BORATORY TEST DATA		
					Filename : GEC76	
Project : 6 Project No.	: GTX-4640		epth : 6 ft.		Elevation :	
Boring No.			est Date : 07. Sest Method : 2		Tested by : jx Checked by : jdt	
Location :	: GEO-7 5 ft. Woburn, MA				•	
Soll Descri	ption : Wet, d	ark brown se	and with grave.	1		
Remarks :			_			
Sieve	Sieve Open		INE SIEVE SET Weight	Cumulative	Percent	
Mesh		illimeters	Retained	Weight Retained	Finer	
			(gm)	(gm)	(%)	
0.5"	0.500	12.70	0.00	0.00	130	
0.375"	0.374	9.51 4.75	21.73 30.96	21.73 52.69	8 D 5 D	
#4 #10	0.187 0.0 79	2.00	28.59	81.28	24	
#20	0.033	0.84	14.67	95.95 101.85	10 4	
#40	0.017 0.010	0.42 0.25	5.90 2.39	104.24	2	
#100	0.006	0.15	0.90	105.14	1 1	
#200 Pan	0.003	C.07	0.43 0.70	105.57 106.27	0	
Total	Dry Weight of	Sample = 114	.42			
ast Aas Aas	iffication M Group Symbol M Group Name HTO Group Symb	: Well-gr ol : A-l-a(0	aded sand with) ragments, Grav	_		



)					Filename: GEO79 Elevation: Tested by: jx Checked by: jdt Percent Finer (%) 100 92 83 78 56 36 19 8 55 36 19 8 5 3	
Wed Jul 1	£ 09:13:52 20	03				Page : 1
			GEOTECHNICAL LA	BORATORY TEST DATA		
Project :	60 Olympia		Denth · 9 fr		Filename : GEO79	
Boring No	. :		Test Date : 07	/02/03	Tested by : jx	
Sample No Location	. : GEO-7 9 fi : Woburn, MA	t.	Test Method : 1	ASTM D 422	Checked by : jdt	
Sample No Location Soil Desc Remarks: Sleve Mesh 1" 0.75" 0.375" #4 #10 #20 #40 #60 #100 #200 Pan Total	ription : Wet.	. dark brown	sand with grave	1		
			DINE CIPTE SEE			
Sieve	Sieve Op	penings	Weight	Cumulative	Percent	
Mesh	Inches	Millimeters	Retained	Weight Retained	Finer	
	1 017	7				
0.75"	0.748	25.70 19.00	0.00 13.11	C.00 13.11	100 92	
0.5"	C.500	12.70	16.63	29.74	83	
U.375" #4	0.374	9.51	9.44	39.18	7B	
#10	0.079	2.00	31.53 35.41	76.71 112 12	56 36	
#20 #45	0.033	0.84	29.60	141.72	19	
#4U #60	0.017	0.42	19.41	161.13	8	
#100	0.006	0.25 0.15	5.24 2 31	166.37	5	
#200	0.003	0.07	1.24	168.68 169.92	3 3	
Pan	Dry Weight o	.e. c ;	4.40	174.32	0	
AA.	SHTO Group Sym	te : Stone :	0) Fragments, Grave	el and Sand		
numa: Ge						



APPENDIX G Laboratory Permanganate Demand Results



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June 19, 2003

Ms.Christine Binger GeoInsight Inc. 319 Littleton Road Westford, MA 01886

Dear Christine:

Enclosed is our report on the depletion of potassium permanganate by the soil samples submitted to us.

These tests extended over nearly a month's time. I fully understand your wish to have a more rapid test. I examined my data from this set of samples with the idea that perhaps one might predict the 22 day out-come by some mathematical projection of the 7 to 10 day results. Unfortunately I could not contrive a consistent projection.

Another possibility, of course, is to run the tests at an elevated temperature.

cc: Jonathan Sanford

Eric Jensen

A Study on the Depletion of Potassium Permanganate in Soils Laboratory Project 60656

Conducted by W.P. Sanford

Summary: Nine soil samples SB-100A, SB-101B, SB101C, SB-102C, SB103A, SB-103C, SB-98, SB-99A and SB-99B submitted by GeoInsight Inc. were reacted with measured increments of potassium permanganate solution. With the exception of samples SB-99A and SB-99B the samples exhibited an initial rapid reduction of the permanganate solution followed by a much slower rate of reduction. Samples SB-99A and SB-99B reduced the permanganate solutions at a rate faster then could be accurately followed by the method and were by far the most reductive.

The following are the ratios of soil weight to permanganate weight after a 22 day reaction period; at which time the reduction had substantially subsided, except for samples SB-99A and SB-99B

Sample ID	Soil wt./ KMnO ₄ wt
SB-100A	5600
SB-101B	3900
SB-101C	4900
SB-102C	1200
SB-103A	3200
SB-103C	2000
SB-98	700
SB-99A	<27
SB-99B	<119

Purpose: To determine the quantity of potassium permanganate (KMnO₄) that will react with known weights of soil samples.

Procedure: Each sample was composited and three 25 gram portions of each sample (weighed to the nearest 0.1g excluding stones) were added to 100 ml amber glass bottles. 50 ml of DI water was added to each bottle followed by the addition of 0.0075 g of potassium permanganate in the form of 1.50 ml of a 0.50% aqueous solution. This resulted in a concentration of permanganate which absorbed light at 578nm on the linear portion of a Beers/Lambert curve.

The resulting 29 bottles (27 samples + 2 without soil) were shaken once a day and a filtrate examined spectroscopically every three to four days. In several cases as the consumption of permanganate approached 100% more permanganate was added usually in increments of 0.0075 grams.

The above procedure was carried out at room temperature (about 22°C).

It was soon apparent that the depletion of permanganate in samples SB-99A and SB-99B could not be followed spectroscopically for two reasons. These soils produced a soluble yellow oxidation product that interfered with the absorption at the analytical wave length.

Secondly the depletion rate was very much faster and the quantity of KMnO₄ consumed was far greater than in the other samples and thus made it impractical to follow.

The procedure with these two samples was to add each day a fixed amount of permanganate and the following day the checked for retention of the pink permanganate color after filtration. If the solution was yellow it was presumed that 100% of the added permanganate had been depleted. Retention of the pink color after several days indicated the end of the reduction process. Strangely at the point of excess permanganate the yellow by-product disappears and the filtrate becomes a clear pink.

Calculations:

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- a) Weight of KMnO₄ depleted = (Init. Wt. KMnO₄)X($\underline{Abs._{init}}$ - $\underline{Abs}._{t}$)
 Abs._{init}
- b) Soil wt/ KMnO_{4 wt} Ratio = Soil wt/ KMnO_{4wt} Depleted

Comments: As is apparent from the attached data, the over-all depletion rate of permanganate is reasonably slow with seven of the nine samples and could be followed in three day intervals. The soil reductive activity essentially ended after 22 days. The exceptions to this were of course samples SB-99A and SB-99B. In the case of these two samples not only was there a yellow by-product, but enough manganese dioxide produced to constantly block the sampling syringe filters. SB-99A was by far the most reductive of the soils and the observations were stopped after 31 days when the ratio of soil weight to permanaganate became less than 27.

Potassium Permanganate Depletion Data

Laboratory Project 60656

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil KMnO4
CD 404B	44			Day 1				
SB-101B	1A	25.3	0.0075	0.693	0.461	0.00251	33	10070
		25.3 25.4					34	
		24.9		0.693				
		27.0	0.0010	0.000	U.112	0.00212	00	9770
				Day 3				0110
	1A							
		25.3	0.0075	0.693	0.335	0.00376	50	6729
		25.3	0.0075	0.693	0.346	0.00397	50	
		24.9	0.0075	0.693	0.326	0.00397	53	
								6580
				Day 7				
	1A	25.3	0.0075	Day 7 0.682	0.285	0.00437	58	E70E
	IA	25.3 25.4	0.0075	0.682	0.283			
		24.9	0.0075	0.682	0.233		66	
		24.3	0.0015	0.002	0.232	0.00433	00	5032 5590
				Day 10				0030
	1A			,				
		25.3	0.0075	0.666	0.217	0.00506	67	5004
		25.4	0.0075	0.666	0.209	0.00515	69	
		24.9	0.0075	0.666	0.186	0.00541	72	4607
								4850
	Day 13							
	1A	25.3	0.0075	0.666	0.193		71	4750
		25.4	0.0075	0.666	0.177		73	
		24.9	0.0075	0.666	0.167	0.00562	75	4431
								4600
Day 16								
	1A	25.3	0.0075	0.666	0.14	0.00592	79	4271
		25.4	0.0075	0.666	0.134		80	4240
		24.9	0.0075	0.666	0.109		84	3970
								4160
Day 19								
	1A						. .	
		25.3	0.0075	0.666	0.128		81	4176
		25.4	0.0075	0.666	0.114		83	4086
		24.9	0.0075	0.666	0.057	0.00686	91	3631
								3960

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMn O4
				Day 22				
SB-101B	1A			_				
		25.3	0.0075	0.666	0.099	0.00639	85	3962
		25.4	0.0075	0.666	0.081	0.00659	88	3856
		24.9	0.0075	0.666	0.077	0.00663	88	3754 3860

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil KMnO4
				Day 1				
SB-101C	2A			•				
		25.1	0.0075	0.693	0.489	0.00221	29	11369
		25.4	0.0075	0.693	0.482	0.00228	30	11123
		25.5	0.0075	0.693	0.486	0.00224	30	11383
								11300
				Day 3				
	2A	05.4	0.0075	0.000	0.440	0.00007	40	0.40.4
		25.1		0.693	0.419			8464
		25.4		0.693	0.4			8010
		25.5	0.0075	0.693	0.416	0.00300	40	8506
				Day 7				8330
	2A	25.1	0.0075	Day 7 0.682	0.339	0.00377	50	6654
	ZA	25.1 25.4		0.682	0.308		55	6176
		25.4 25.5		0.682	0.300		52	6588
		20.0	0.0075	0.002	0.55	0.00007	UZ.	6470
				Day 10				0470
	2A	25.1	0.0075	0.666	0.28	0.00435	58	5774
		25.4		0.666	0.311	0.00400		6354
		25.5		0.666	0.297			6137
								6090
				Day 13				
	2A							
		25.1	0.0075	0.666	0.245			5294
		25.4	0.0075	0.666	0.288	0.00426		5967
		25.5	0.0075	0.666	0.281	0.00434	58	5882
								5710
Day 16								
	2A	25.4	0.0075	0.666	0.042	0.00540	60	4000
		25.1	0.0075	0.666	0.213	0.00510	68	4920
		25.4 25.5	0.0075 0.0075	0.666 0.666	0.248 0.242	0.00471 0.00477	63 64	5396 5341
		20.0	0.0075	0.000	0.242	0.00477	0-4	5220
				Day 19				JZZU
2A								
		25.1	0.0075	0.666	0.2	0.00525	70	4783
		25.4	0.0075	0.666	0.236		65	5245
		25.5	0.0075	0.666	0.233		65	5230
		= - / -						5080

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMnO4
			_	Day 22				
SB-101C	2A			-				
		25.1	0.0075	0.666	0.178	0.00550	73	4567
		25.4	0.0075	0.666	0.225	0.00497	66	5115
		25.5	0.0075	0.666	0.217	0.00506	67	5043
								4910

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Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMn O4
				Day 1				
SB-100A	3A	25.3	0.0075	0.693	0.507	0.00201	27	12568
		25.2					27	12655
		25.2					26	13081
		20.2	0.0070	0.000	0.010	0.00100	20	12800
				Day 3				12000
	3A			,				
		25.3	0.0075	0.693	0.425	0.00290	39	8723
		25.2	0.0075	0.693	0.431	0.00284	38	8887
		25.2	0.0075	0.693	0.447	0.00266	35	9465
								9030
				Day 7				
	3A	25.3	0.0075	0.682	0.41	0.00299	40	8458
		25.2	0.0075	0.682	0.397		42	8040
		25.2	0.0075	0.682	0.433	0.00274	37	9203
								8570
				Day 10				
	3A	25.3	0.0075	Day 10 0.666	0.34	0.00367	49	6800
	JA	25.3 25.2	0.0075	0.666	0.331	0.00387	50	6892 6680
		25.2 25.2	0.0075	0.666	0.363	0.00377	45	7385
		20.2	0.0073	0.000	0.303	0.00541	40	6990
								0330
				Day 13				
	3A			•				
		25.3	0.0075	0.666	0.303	0.00409	55	6189
		25.2	0.0075	0.666	0.316	0.00394	53	6394
		25.2	0.0075	0.666	0.338	0.00369	49	6822
								6470
				Day 16				
	3A	05.0	0.0075	0.000	0.074	0.00445	50	:5000
		25.3	0.0075	0.666	0.271	0.00445	59 50	5688
		25.2 25.2	0.0075 0.0075	0.666 0.666	0.279 0.313	0.00436 0.00398	58 53	5782
		23.2	0.0075	0.000	0.313	0.00396	55	6339
				Day 19				5940
	3A			-uy 10				
	1	25.3	0.0075	0.666	0.206	0.00518	69	4884
		25.2	0.0075	0.666	0.268	0.00448	60	5623
		25.2	0.0075	0.666	0.297	0.00416	55	6064
			-:· -	3.555	z. _ _,			5520

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMn O4
			_	Day 22				
SB-100A	3A			•				
		25.3	0.0075	0.666	0.23	0.00491	65	5153
		25.2	0.0075	0.666	0.272	0.00444	59	5680
		25.2	0.0075	0.666	0.295	0.00418	56	6032
								5620

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight		Filtrate Color	% of Initial KMnO4	Ratio <u>Soil</u> KMnO4
0D 004				Day 1			
SB-99A	4A	25.2	0.0075			100	3360
		25.2				100	3360
		25.4	0.0075			100	3387
				Day 9			3370
	4A			Day 3			
	77.1	25.2	0.0225		lt.yellow	100	1120
		25.2	0.0225		•	100	1120
		25.4	0.0225			100	1129
							1120
				Day 7			
	4A	25.2	0.06	•	lt. Yellow	100	420
		25.2	0.06			100	420
		25.4	0.06			100	423
				Day 10			420
	4A	•		Day 10			
	•	25.2	0.09		yellow	100	280
		25.2	0.09		•	100	280
		25.4	0.09			100	282
							280
				Day 13			
	4A	25.2	0.105	-	dk. Yellow	100	240
		25.2	0.105			100	240
		25.4	0.105			100	242
				Day 16			240
	4A						
		25.2	0.225		dk. Yellow	100	112
		25.2	0.225			100	112
		25.4	0.225			100	113
				Day 19			112
	4A			•			
		25.2	0.375		dk. Yellow	100	67
		25.2	0.375			100	67
		25.2	0.373			100	68
							67

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Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Day 22	Filtrate Color Filtrate	% of Initial KMnO4	Ratio <u>Soil</u> KMn 04
SB-99A	4A	25.2 25.2 25.2	0.625		dk yellow	100 100 100	40
				Day 26			
	4A 4A	25.2 25.2 25.2 25.2 25.2	0.675 0.675 0.775	Day 30	yellow	100 100 100 100 100	37 37 37 37
		25.2				100	
				Day 31			
	4A	25.2 25.2 25.2	0.925		yellow	100 100 100	27

Test discontinued

Sample ID Lab ID	Sample Weight	Initial KMnO4 Weight		Filtrate Color	% of Initial KMnO4	Ratio <u>Soil</u> KMnO4
			Day 1			
SB-99B 5A						
	25.4				100	
	25.8				100	
	26.6	0.0075			100	3547 3460
			Day 3			3400
5A			, -			
	25.4	0.0225		It. Yellow	100	1129
	25.8				100	
	26.6	0.0225			100	
			D 7			1150
5A			Day 7			
ЭА	25.4	0.0525		It. Yellow	100	484
	25.8			IL. I CHOW	100	
	26.6				100	
						490
			Day 10			
5A						
	25.4			yellow	100	
	25.8 26.6				100 100	_
	20.0	0.0023			100	322 320
			Day 13			020
5A			-			
	25.4			yellow	100	
	25.8				100	
	26.6	0.0975			100	
			Day 16			280
5A			Du, 10			
	25.4	0.105		dk. Yellow	100	241
	25.8	0.105			100	
	26.6	0.105			100	
			Day 10			246
5A			Day 19			
JA	25.4	0.1625		dk. Yellow	100	163
	25.8	0.1625		3K. 1010W	100	
	26.6	0.1625			100	

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Day 22		% of Initial KMnO4	Ratio <u>Soil</u> KMn O4
SB-99B	5A	25.4		Day LL	dk yellow	100	152
2D-33D	JA	25.4 25.8			an year	100	
		26.6				100	159
							155
				Day 26			
	5A	25.4	0.2175		yellow	100	
		25.8	0.2175			100	
		26.6	0.2175			100	
							119
				Day 30			
	5A	25.4			pink		
		25.8					
		26.6	0.2675				

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMn O4
				Day 1				
SB-103A	6A	05.0	0.0075	0.000	0.400	0.00044	20	400.4
		25.2 25.6		0.693 0.693				10349 10655
		25.3		0.693			39	8690
								8910
				Day 3				
	6A							
		25.2		0.693			48	6992
		25.6 25.3	0.0075 0.0075	0.693 0.693			45 58	7533 5772
		20.0	0.0075	0.033	0.200	0.00430	50	6770
				Day 7				
	6A	25.2	0.0075	Day 7 0.682	0.274	0.00449	60	5616
	0,,	25.6	0.0075	0.682	0.298		56	6062
		25.3	0.0075	0.682	0.156		77	4374
								5350
				Day 10				
	6A	05.0	0.0075	0.000	0.047	0.00500		
		25.2 25.6	0.0075 0.0075	0.666 0.666	0.217 0.243		67 64	4984
		25.6 25.3	0.0075	0.666	0.243	0.00476 0.00660	64 88	5374 3834
		20.0	0.0070	0.000	0.00	0.00000	00	4730
				Day 13				
	6A			Du y .0				
		25.2	0.0075	0.666	0.192	0.00534	71	4721
		25.6	0.0075	0.666	0.22	0.00502	67	5097
		25.3	0.0075	0.666	0.037	0.00708	94	3572 4460
				Day 16				
	6A	05.0	0.0075	0.000	0.400	0.00000	70	45
		25.2 25.6	0.0075 0.0075	0.666 0.666	0.139 0.169		79 75	4246
		25.3	0.0075	0.666	0.109	0.00360	100	4574 3373
		20.0			J	0.007.00	700	4060
	C.4			Day 19				
	6A	25.2	0.015	1.294	0.771	0.00606	40	1157
		25.2 25.6	0.015	1.294	0.771	0.00606	40	4157 4223
		25.3	0.015	1.294	0.596	0.00809	54	3127
				·			٠.	3840

The initial absorbance of Day 19 is calculated, not measured

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil KMnO4
			_	Day 22				
SB-103A	6A							
		25.2	0.015	1.294	0.705	0.00683	46	3691
		25.6	0.015	1.294	0.698	0.00691	46	3705
		25.3	0.015	1.294	0.481	0.00942	63	2685
								3360
				Day 26				
	6A							
		25.2	0.015	1.294	0.659	0.00736	49	3423
		25.6	0.015	1.294	0.668	0.00726	48	3528
		25.3	0.015	1.294	0.41	0.01025	68	2469
								3140

SB-103C 7A	Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMn O4
25.4 0.0075 0.693 0.355 0.00366 49 6944 25.5 0.0075 0.693 0.291 0.00435 58 5861 6049 6280					Day 1				
7A	SB-103C	7A	25.4	0 0075	0.603	0.255	0.00266	40	6044
TA 25.4									
7A 25.4 0.0075 0.693 0.198 0.00536 71 4741 25.5 0.0075 0.693 0.16 0.00577 77 4421 25.5 0.0075 0.693 0.152 0.00585 78 4355 4510 7A 25.4 0.0075 0.693 0.152 0.00585 78 4355 4510 7A 25.4 0.0075 0.682 0.085 0.00657 88 3869 25.5 0.0075 0.682 0.061 0.00683 91 3734 25.5 0.0075 0.682 0.042 0.00704 94 3623 3740 7A 25.4 0.015 1.347 0.526 0.00914 61 2778 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 7A 25.4 0.015 1.347 0.492 0.00921 61 2769 2740 7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 7A 7A 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 7A 7A 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 25.5 0.015 1.347 0.392 0.01063 71 2388 2420 7A 7A 7A 7A 7A 7A 7A 7A 7A 7									
7A 25.4 0.0075 0.693 0.198 0.00536 71 4741 25.5 0.0075 0.693 0.16 0.00577 77 4421 25.5 0.0075 0.693 0.152 0.00585 78 4355 4510 7A 25.4 0.0075 0.693 0.152 0.00585 78 4355 4510 7A 25.4 0.0075 0.682 0.085 0.00657 88 3869 25.5 0.0075 0.682 0.061 0.00683 91 3734 25.5 0.0075 0.682 0.042 0.00704 94 3623 3740 7A 25.4 0.015 1.347 0.526 0.00914 61 2778 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 7A 25.4 0.015 1.347 0.492 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 25.5 0.015 1.347 0.392 0.01063 71 2388 2420 7A Day 16 7A Day 19 7A					Day 2				6280
25.4 0.0075 0.693 0.198 0.00536 71 4741 25.5 0.0075 0.693 0.16 0.00577 77 4421 25.5 0.0075 0.693 0.152 0.00585 78 4355 4510 **Pay 7** **Pay 7** **Pay 10** **P		7A			Day 3				
TA 25.5									
TA 25.4									
7A			25.5	0.0075	0.693	0.152	0.00585	78	
7A					Day 7				
25.5 0.0075 0.682 0.061 0.00683 91 3734 25.5 0.0075 0.682 0.042 0.00704 94 3623 3740 TA Day 10 7A 25.4 0.015 1.347 0.526 0.00914 61 2778 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 Day 13 7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19		7Δ	25.4	0.0075	•	0.085	0.00657	88	3869
7A Day 10 Day 10		10							
7A 25.4 0.015 1.347 0.526 0.00914 61 2778 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01184 79 2146 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19									
7A 25.4 0.015 1.347 0.526 0.00914 61 2778 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 Pay 13 7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19									3740
25.4 0.015 1.347 0.526 0.00914 61 2778 25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 **Day 13** 7A** 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 **Day 16** 7A** 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 **Day 19**					Day 10				
25.5 0.015 1.347 0.492 0.00952 63 2678 25.5 0.015 1.347 0.52 0.00921 61 2769 2740 **Page 13** TA** Day 13** 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16** Day 16** Day 16** Day 16** Day 16** Day 19** Da		7A	05.4	0.045	4 0 4 7	0.500	0.00044	61	0770
25.5 0.015 1.347 0.52 0.00921 61 2769 2740 Day 13 7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19									
7A Day 13 7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19									
7A 25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19									
25.4 0.015 1.347 0.45 0.00999 67 2543 25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19					Day 13				
25.5 0.015 1.347 0.369 0.01089 73 2341 25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19		7A							85.46
25.4 0.015 1.347 0.392 0.01063 71 2388 2420 Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19 7A									
Day 16 7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19 7A									
7A 25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19 7A									
25.4 0.015 1.347 0.342 0.01119 75 2270 25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19		~ 4			Day 16				
25.5 0.015 1.347 0.248 0.01224 82 2084 25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19		/A	25.4	0.015	1 347	0.342	0.01119	75	2270
25.4 0.015 1.347 0.284 0.01184 79 2146 2170 Day 19									
Day 19 7A								79	
7A					Day 10				2170
		7 A			Day 13				
			25.4	0.015	1.347	0.302	0.01164	78	2183
25.5 0.015 1.347 0.203 0.01274 85 2002				0.015	1.347	0.203	0.01274		2002
25.4 0.015 1.347 0.223 0.01252 83 2029 2070			25.4	0.015	1.347	0.223	0.01252	83	

The initial absorbances of Days 10,13,16 and 19 are calculated,not measure

Sample ID	Lab iD	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMnO4	
SB-103C	7A			Day 22					
		25.4	0.015	1.374	0.244	0.01234	82	2059	
		25.5	0.015	1.374	0.139	0.01348	90	1891	
		25.4	0.015	1.374	0.163	0.01322	88	1921 1960	

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMnO4
				Day 1				
SB-102C	8A	05.4	0.0075	0.000	0.400	0.00540	70	
		25.1 25.5		0.693	0.192 0.2			
		25.5 25.4		0.693 0.693	0.198			
		20.4	0.0075	0.053	0.130	0.00550	7.1	4741 4720
				Day 3				4/20
	8A			- - - - - - - - - -				
		25.1	0.0075	0.693	0.045	0.00701	94	3579
		25.5		0.693	0.077		89	
		25.4	0.0075	0.693	0.06	0.00685	91	
								3700
				Day 7				
	A8							
		25.1	0.015	1.347	0.145		89	_
		25.5		1.347	0.152		89	
		25.4	0.015	1.347	0.152	0.01331	89	
				Day 10				1900
	8A			Day 10				
	UA	25.1	0.015	1.347	0.04	0.01455	97	1725
		25.5	0.015	1.347	0.047		97	
		25.4	0.015	1.347	0.035	0.01461	97	
			0,0,0		5.555		٠.	1740
				Day 13				
	A8							
		25.1	0.0225	1.87	0.341	0.01840	82	1364
		25.5	0.0225	1.87	0.353	0.01825	81	1397
		25.4	0.0225	1.87	0.335	0.01847	82	
				Day 40				1380
	O A			Day 16				
	8A	25.1	0.0225	1.87	0.124	0.02101	93	1105
		25.1	0.0225	1.87	0.124	0.02101	93	
		25.4	0.0225	1.87	0.126	0.02030	94	
		~ ♥.¬	0.0220		5.110	5.52110	5 4	1204
				Day 19				.200
	8A			-				
		25.1	0.0225	1.87	0.06	0.02178	97	1153
		25.5	0.0225	1.87	0.061	0.02177	97	
		25.4	0.0225	1.87	0.052	0.02187	97	
								1160

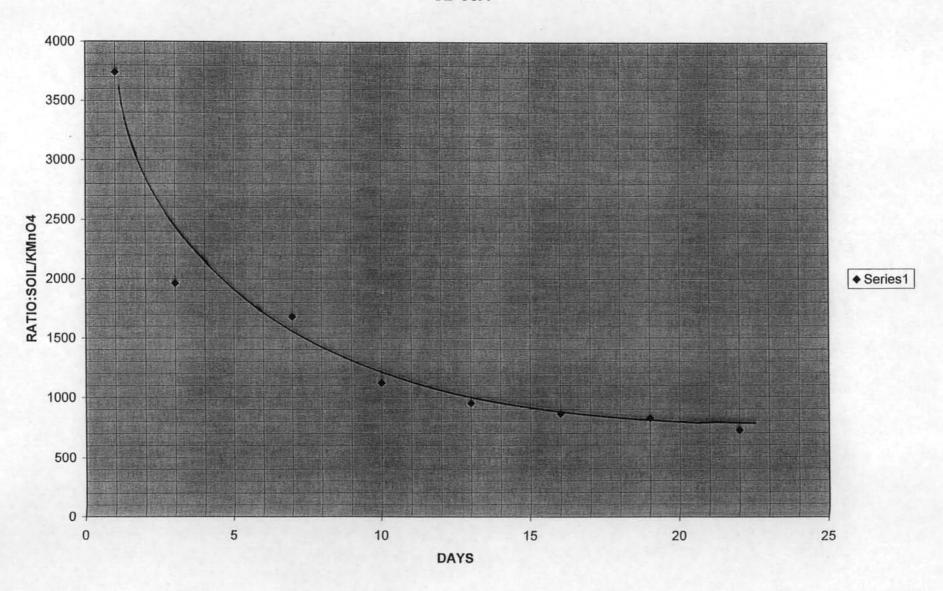
With the exception of Days 1 and 3 the initial absorbances are calculated

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil KMn O4
			-	Day 22				
SB-102C	A8			•				
		25.1	0.0225	1.87	0.026	0.02219	99	1131
		25.5	0.0225	1.87	0.012	0.02236	99	1141
		25.4	0.0225	1.87	0.012	0.02236	99	1136
								1140

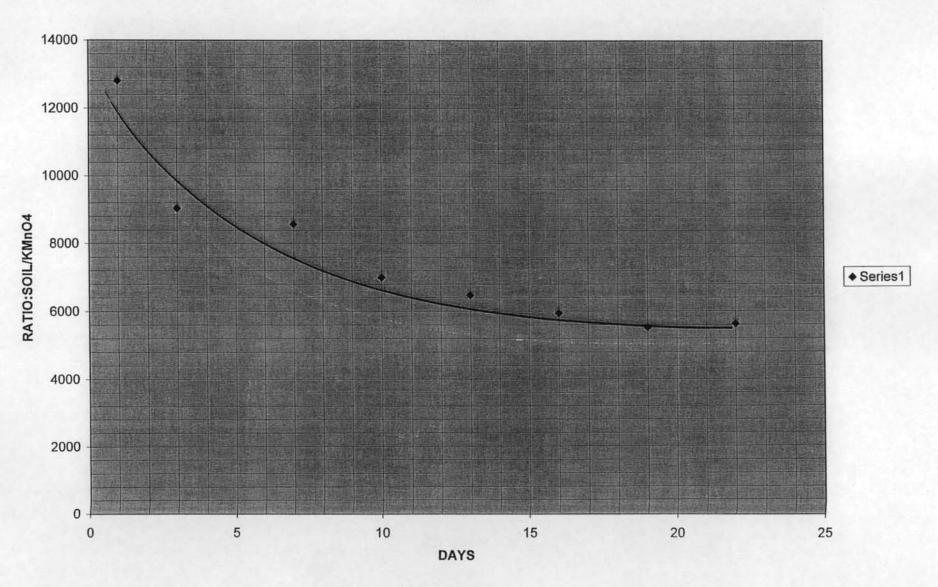
Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	Initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio <u>Soil</u> KMnO4
				Day 1				
SB-98	9A	05.4	0.0075	0.000	0.050	0.00007		
		25.1 25.1	0.0075 0.0075	0.693 0.693				
		25.2		0.693				
								3740
				Day 3				
	9A			•				
		25.1	0.015	1.347				
		25.1 25.2	0.015 0.015	1.347 1.347				
		25.2	0.015	1.547	0.210	0.01257	04	2004 1960
				Day 7				
	9A			-u, ,				
		25.1	0.015	1.347			100	1673
		25.1	0.015	1.347			100	
		25.2	0.015	1.347	0	0.01500	100	1680 1680
				Day 10				
	9A			-				
		25.1	0.0225	1.914	0	0.02250	100	1116
		25.1 25.2	0.0225 0.0225	1.914 1.914	0	0.02250 0.02250	100 100	1116 1120
		20.2	0.0223	1.514	Ü	0.02230	100	1120 1120
				Day 13				
	9A							
		25.1	0.03	2.45	0.297	0.02636	88	952
		25.1 25.1	0.03 0.03	2.45 2.45	0.287 0.312	0.02649 0.02618	88 87	948 959
					0.012	0.02010	O.	950
	9A			Day 16				
	JA	25.1	0.03	2.45	0.03	0.02963	99	847
		25.1	0.03	2.45	0.077	0.02906	97	864
		25.1	0.03	2.45	0.114	0.02860	95	877 860
				Day 19				900
	9 A			•				
		25.1	0.0373	3.06	0.557	0.03051	82	823
		25.1	0.0375	3.06	0.581	0.03038	81	826
		25.1	0.0375	3.06	0.496	0.03142	84	799
		With the ex	ception of	Day 1 the	initial abso	rbances a	re calculate	820 ed

Sample ID	Lab ID	Sample Weight	Initial KMnO4 Weight	initial Abs.	Time T Abs.	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil KMnO4
			_	Day 22				
SB-98	9A							
		25.1	0.0373	3.06	0.202	0.03484	93	720
		25.1	0.0373	3.06	0.182	0.03508	94	715
		25.1	0.0373		0.245	0.03431	92	731
		20.1	3.00.0					720

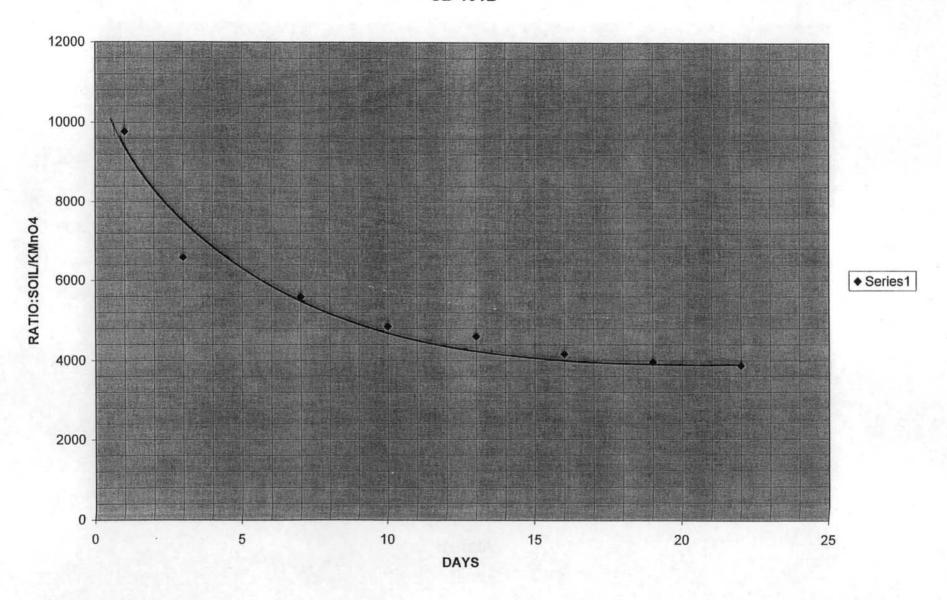
SB-98A



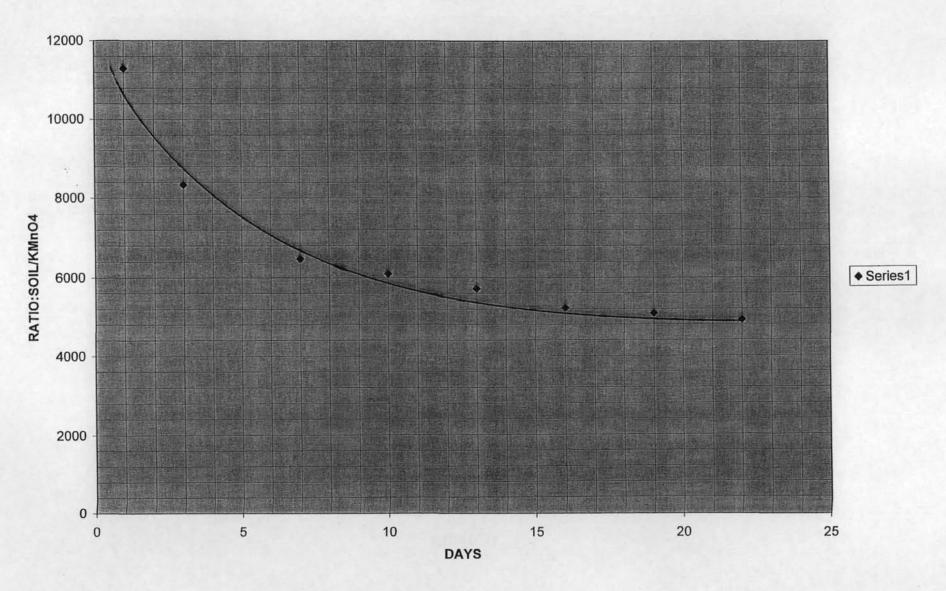
SB-100A



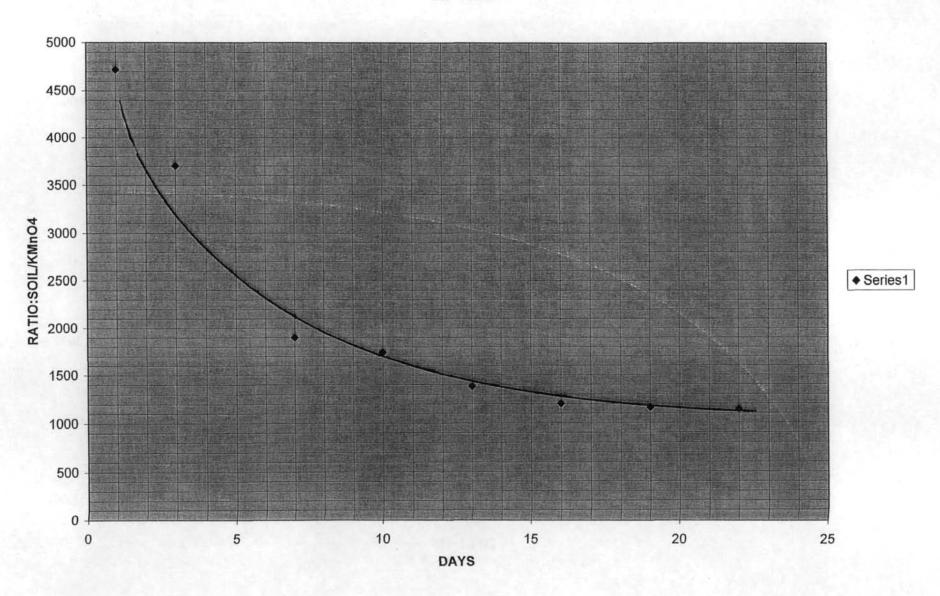
SB-101B



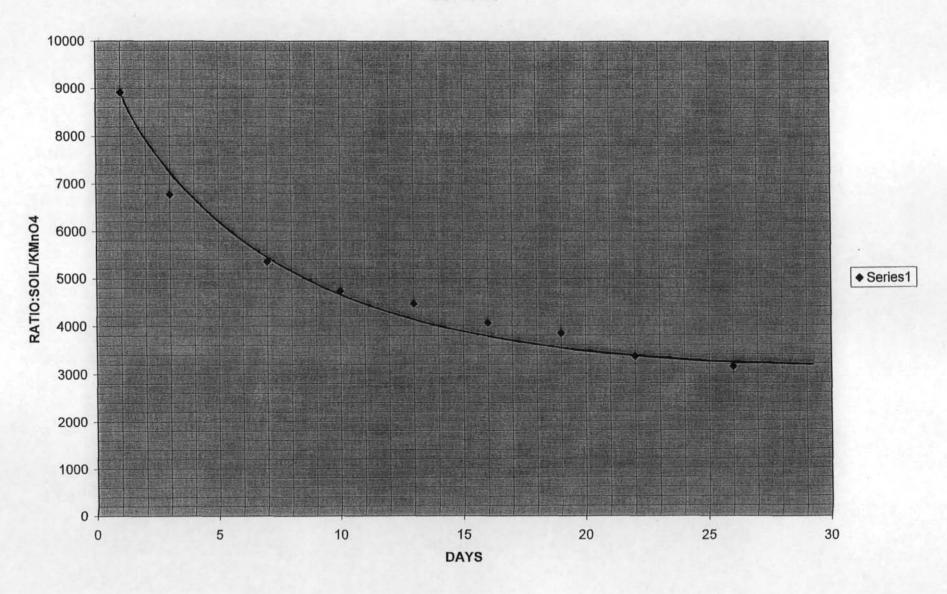
SB-101C



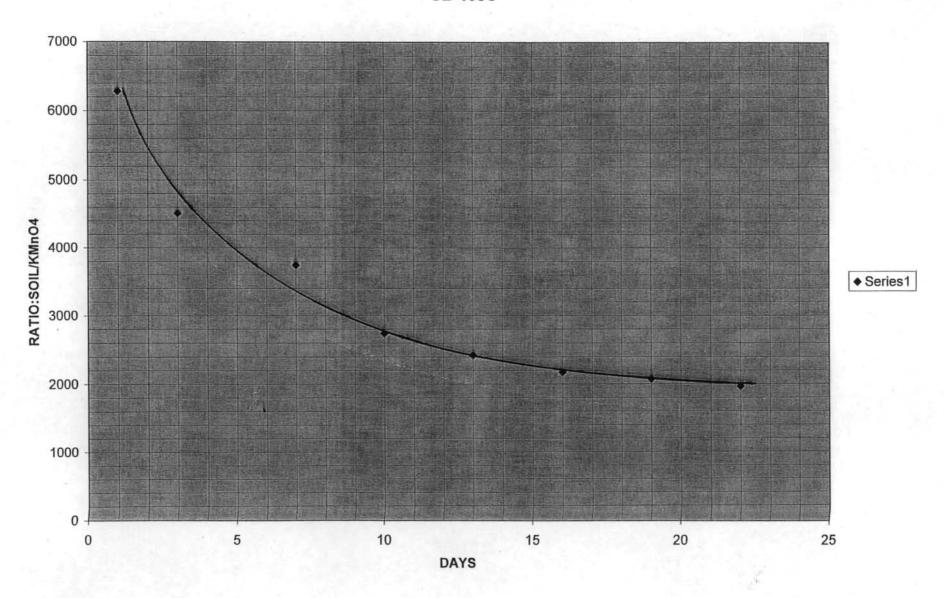
SB-102C



SB-103A



SB-103C





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Telephone (508) 759-4441 FAX (508) 759-4475 www.groundwateranalytical.com

July 18, 2003

Ms. Christine Binger GeoInsight Inc. 319 Littleton Road Westford, MA 01886

Dear Christine:

Enclosed is our report on the depletion of potassium permanganate by two soil samples identified as Geo 5-16' and Geo SB-91-12'. This was our laboratory project 62089.

I am hopeful that these bench tests will correlate with your field-work. .

Wes Sanford

cc: Jonathan Sanford Eric Jensen

A Study on the Depletion of Potassium Permanganate in Soils Laboratory Project 62089

Conducted by W.P. Sanford

Summary: Two soil samples Geo- SB-91-12' and Geo 5-16' were reacted at room temperature with measured increments of a potassium permanganate solution. The depletion of permanganate was followed by spectroscopic light absorption. The light absorption was noted in increments of 3 days. The examination was concluded when the plots of Soil Wt. vs Permanganate Wt. became asymptotic to the abscissa. In the case of both samples this occurred after 23 days.

Specifically: Soil sample Geo-SB-91-12' had a Soil Wt./ KMnO₄ Wt. ratio of <u>4500</u> after 23 days.

Soil sample Geo 5-16' had a Soil Wt./KMnO₄ Wt. ratio of $\underline{1500}$ after 23 days.

Purpose: To determine the soil weight to KMnO₄ reaction weight ratio for two soil samples.

Procedure: Each sample was composited and three 25 gram portions of each sample (excluding stones) were added to 100 ml amber glass bottles. 50 ml. of DI water was added to each bottle, followed by the addition of 0.0075g of potassium permanganate in the form of a 0.050% aqueous solution. This resulted in a concentration of permanganate that absorbed monochromatic light at 578nm on the linear portion of a Beers/Lambert curve.

The resulting 7 bottles (6 sample portions + 1 without soil) were shaken once a day and a filtrate examined spectroscopically every three days. In one case (SB-5-16') the consumption of permanganate approached 100% before the Soil/KMnO₄ ratio curve became asymptotic; in that case another increment of permanganate was added. The above procedure was carried out at room temperature. (about 22°C)

Calculations: Weight of KMnO₄ depleted = (Init. Wt KMnO₄) $X(\underline{Abs}_{.init}-\underline{Abs}_{.t})$ Abs._{init}.

Soilwt/KMnO4wt Ratio = Soilwt/KMnO4wt Depleted

Comments: Although sample Geo-5-16' was composited there was a wider variation between the individual sample portions then I would have wished. The average value is, I believe, reasonable sound.

Potassium Permanganate Depletion Data

Laboratory Project 62089

Geolnsight Samples Geo SB-91-12' and Geo 5-16'

Sample ID	Lab ID	Sample Weight	Initial Weight KMnO4	Initial Abs	Time T Abs	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil Wt./ KMnO4
			Elapsed T	ime in Day	s =1			
SB-91-12	62089-1A							
	а	25.1	0.0075	0.697	0.516	0.001948	25.96844	12887.44
	b	25	0.0075	0.697	0.508	0.002034	27.11621	12292.77
	C	25.1	0.0075	0.697	0.483	0.002303	30.70301	10900.12
								12000
			Elapsed T	ime in Days	s=3			
SB-91-12	62089-1A							
	a	25.1	0.0075	0.697	0.429	0.002884	38.4505	8703.831
	b	25	0.0075	0.697	0.45	0.002658	35.43759	9406.208
	С	25.1	0.0075	0.697	0.395	0.00325	43.32855	7723.929
								8610
			Elapsed Ti	me in Days	= 8			
SB-91-12	62089-1A			Duy				
	а	25.1	0.0075	0.697	0.328	0.003971	52.94118	6321.481
	b	25	0.0075	0.697	0.353	0.003702	49.35438	6753.876
	C	25.1	0.0075	0.697	0.294	0.004336	57.81923	5788.156
								6290
OD 04 40	00000 44		Elapsed Ti	me in Days	=11			
SB-91-12	62089-1A	05.4						
	а	25.1	0.0075	0.697	0.298	0.004293	57.24534	5846.182
	b	25	0.0075	0.697	0.33	0.003949	52.65423	6330.609
	С	25.1	0.0075	0.697	0.241	0.004907	65.42324	5115.409
								5760
			Elapsed Ti	me in Days	=14			
SB-91-12	62089-1A		_impood iii	ine in Dayo				
	а	25.1	0.0075	0.697	0.255	0.004756	63.41463	5277.436
	b	25	0.0075	0.697	0.303	0.00424	56.52798	5896.785
	C	25.1	0.0075	0.697	0.204	0.005305	70.73171	4731.494
								5300
OD 04 40			Elapsed Tir	me in Days	= 17			
SB-91-12	62000 44							
	62089-1A	05.4	0.0075	0.007	0.000	0.005000	07 4 4 4 0 4	4004 5 :-
	a	25.1	0.0075	0.697	0.229	0.005036	67.14491	4984.245
	b	25	0.0075	0.697	0.269	0.004605	61.40603	5428.349
	С	25.1	0.0075	0.697	0.161	0.005768	76.901	4351.915

4510

Elapsed Time in Days = 20

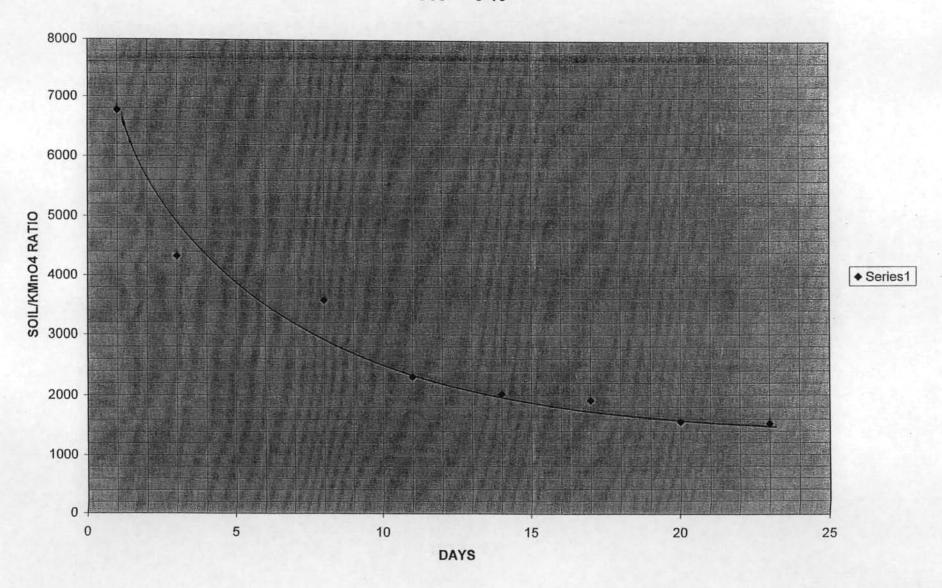
SB-91-12	62089-A	25.1	0.0075	0.697	0.172	0.005649	75.32281	4443.098	
		25	0.0075	0.697	0.234	0.004982	66.42755	5017.999	
		25.1	0.0075	0.697	0.116	0.006252	83.35725	4014.848	
								4490	
		E	lapsed Tim	e in Days =	23				
SB-91-12	62089-A	25.1	0.0075	0.697	0.168	0.005692	75.8967	4409.502	
		25	0.0075	0.697	0.231	0.005014	66.85796	4985.694	
		25.1	0.0075	0.697	0.133	0.006069	80.91822	4135.863	

Sample ID	Lab ID	Sample Weight	Initial Weight KMnO4	Initial Abs	Time T Abs	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil Wt./ KMnO4
			Elapsed T	ime in Days	s =1			
Geo 5-16'	62089-2A							
	а	25.2	0.0075	0.697	0.424	0.002938	39.16786	8578.462
	b	25.5	0.0075	0.697	0.329	0.00396	52.7977	6439.674
	С	25.5	0.0075	0.697	0.249	0.004821	64.27547	5289.732 6770
			Elapsed Ti	ime in Days	s =3			
Geo 5-16'	62089-2A			- 1 -				
	а	25.2	0.0075	0.697	0.23	0.005025	67.00143	5014.818
	b	25.5	0.0075	0.697	0.136	0.006037	80.4878	4224.242
	С	25.5	0.0075	0.697	0.062	0.006833	91.10473	3731.969 4320
			Elapsed Ti	me in Days	. =0			
Geo 5-16'	62089-2A		Liapseu II	ine in Days	s -o			
Geo 3-10		25.2	0.0075	0.697	0.088	0.006553	87.37446	3845.517
	a b	25.5	0.0075	0.697	0.000	0.000333	97.56098	3485
	C	25.5	0.0075	0.697	0.003	0.007317	99.56958	3414.697
		20.0	0.0073	0.037	0.003	0.007400	33.50350	3580
			Elapsed Ti	me in Dave	-44			
Geo 5-16'	62089-2A		Elapseu II	me in Days	,-11			
0000	a	25.2	0.015	1.355	0.536	0.009066	60.4428	2779.487
	b	25.5	0.015	1.355	0.308	0.01159	77.26937	2200.096
	c	25.5	0.015	1.355	0.174	0.013074	87.15867	1950.466
								2300
			Elapsed Ti	me in Days	=14			
Geo 5-16'	62089-2A							
	а	25.2	0.015	1.355	0.411	0.01045	69.6679	2411.441
	b	25.5	0.015	1.355	0.14	0.01345	89.6679	1895.885
	С	25.5	0.015	1.355	0.038	0.014579	97.19557	1749.051 2020
	00000 51		Elapsed Ti	me in Days	= 17			
Geo 5-16'	62089-2A					0.044000	== 0====	0000
	a	25.2	0.015	1.355	0.334		75.35055	2229.579
	b	25.5	0.015	1.355	0.059	0.014347	95.64576	1777.392
	С	25.5	0.015	1.355	0.013	0.014856	99.04059	1716.468 1910

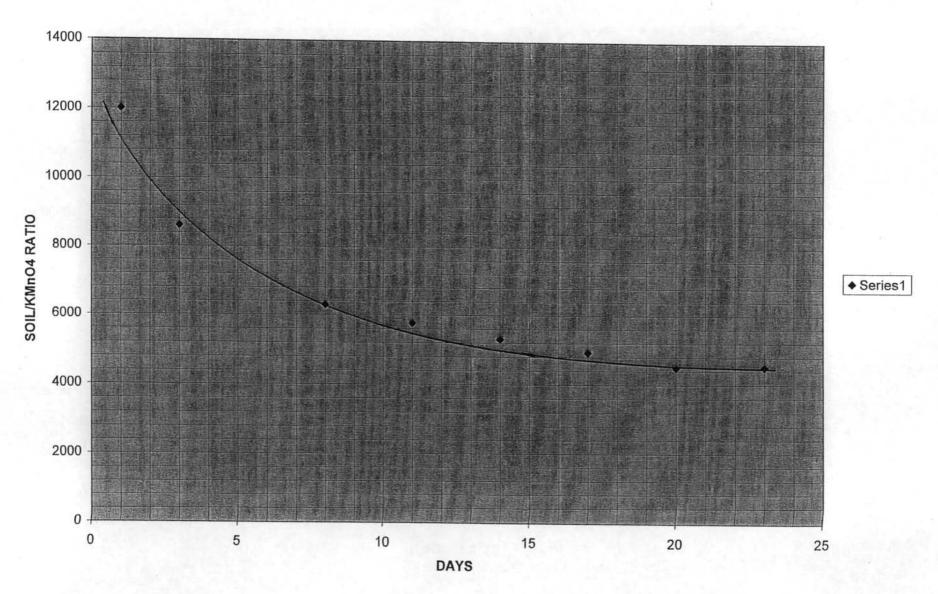
Elapsed Time in Days = 2	VS - 20	Days	ш	Illile	pseu	
--------------------------	---------	------	---	--------	------	--

		Lie	apseu i iiii	e III Days -	- 20				
Geo 5-16'	62089-2A								
	а	25.2	0.02	1.772	0.529	0.014029	70.14673	1796.235	
	b	25.5	0.02	1.772	0.277	0.016874	84.36795	151 1.237	
	С	25.5	0.02	1.772	0.106	0.018804	94.01806	1356.122	
								1550	
		Ela	apsed Tim	e in Days =	=23				
Geo 5-16'	62089-2A								
	а	25.2	0.02	1.772	0.579	0.013465	67.32506	1871.517	
	b	25.5	0.02	1.772	0.165	0.018138	90.68849	1405.912	
	С	25.5	0.02	1.772	0.021	0.019763	98.8149	1290.291	
								1522	

Geo 5-16'



SB 91-12'





Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532

Telephone (508) 759-4441 FAX (508) 759-4475 www.groundwateranalytical.com

July 18, 2003

Ms. Christine Binger GeoInsight Inc. 319 Littleton Road Westford, MA 01886

Dear Christine:

Enclosed is our report on the depletion of potassium permanganate by two soil samples identified as Geo 5-16' and Geo SB-91-12'. This was our laboratory project 62089.

I am hopeful that these bench tests will correlate with your field-work. .

Wes Sanford

cc: Jonathan Sanford Eric Jensen

GROUNDWATER ANALYTICAL

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A Study on the Depletion of Potassium Permanganate in Soils Laboratory Project 62089

Conducted by W.P. Sanford

Summary: Two soil samples Geo- SB-91-12' and Geo 5-16' were reacted at room temperature with measured increments of a potassium permanganate solution. The depletion of permanganate was followed by spectroscopic light absorption. The light absorption was noted in increments of 3 days. The examination was concluded when the plots of Soil Wt. vs Permanganate Wt. became asymptotic to the abscissa. In the case of both samples this occurred after 23 days.

Specifically: Soil sample Geo-SB-91-12' had a Soil Wt./ $KMnO_4$ Wt. ratio of $\underline{4500}$ after 23 days.

Soil sample Geo 5-16' had a Soil Wt./KMnO₄ Wt. ratio of <u>1500</u> after 23 days.

Purpose: To determine the soil weight to KMnO₄ reaction weight ratio for two soil samples.

Procedure: Each sample was composited and three 25 gram portions of each sample (excluding stones) were added to 100 ml amber glass bottles. 50 ml. of DI water was added to each bottle, followed by the addition of 0.0075g of potassium permanganate in the form of a 0.050% aqueous solution. This resulted in a concentration of permanganate that absorbed monochromatic light at 578nm on the linear portion of a Beers/Lambert curve.

The resulting 7 bottles (6 sample portions + 1 without soil) were shaken once a day and a filtrate examined spectroscopically every three days. In one case (SB-5-16') the consumption of permanganate approached 100% before the Soil/KMnO₄ ratio curve became asymptotic; in that case another increment of permanganate was added. The above procedure was carried out at room temperature. (about 22°C)

Calculations: Weight of KMnO₄ depleted = (Init. Wt KMnO₄) $X(\underline{Abs._{init}}$ - $\underline{Abs._{t}}$)
Abs._{init}.

Soilwt/KMnO4wt Ratio = Soilwt/KMnO4wt Depleted

Comments: Although sample Geo-5-16' was composited there was a wider variation between the individual sample portions then I would have wished. The average value is, I believe, reasonable sound.

Potassium Permanganate Depletion Data

Laboratory Project 62089

Geolnsight Samples Geo SB-91-12' and Geo 5-16'

Sample ID	Lab ID	Sample Weight	Initial Weight KMnO4	Initial Abs	Time T Abs	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil Wt./ KMnO4
			Elapsed T	ime in Day	s =1			
SB-91-12	62089-1A							
	а	25.1	0.0075	0.697	0.516	0.001948	25.96844	12887.44
	b	25	0.0075	0.697	0.508	0.002034	27.11621	12292.77
	С	25.1	0.0075	0.697	0.483	0.002303	30.70301	10900.12 12000
			Elancod T	ime in Day	3			34.1533.16
SB-91-12	62089-1A		Liapseu	illie III Day	5-0			
OD-31-12	a	25.1	0.0075	0.697	0.429	0.002884	38.4505	8703.831
	b	25		0.697	0.45			
	C	25.1	0.0075	0.697	0.395			
	C	20.1	0.0075	0.037	0.000	0.00525	43.32,033	8610
			Elapsod T	ime in Days	0			
SB-91-12	62089-1A		Liapseu I	illie ili Days	5-0			
30-91-12	a	25.1	0.0075	0.697	0.328	0.003971	52.94118	6321.481
	b	25	0.0075	0.697	0.353	0.003771		6753.876
	c	25.1	0.0075	0.697	0.294	0.004336	57.81923	5788.156 6290
			Elapsed T	ime in Days	s=11			
SB-91-12	62089-1A							
	а	25.1	0.0075	0.697	0.298	0.004293	57.24534	5846.182
	b	25	0.0075	0.697	0.33	0.003949	52.65423	6330.609
	С	25.1	0.0075	0.697	0.241	0.004907	65.42324	5115.409 5760
			Flores d T	i- D	-44			
SB-91-12	62089-1A		Elapsed 1	ime in Days	5 = 14			
30-91-12	Was a	25.1	0.0075	0.697	0.255	0.004756	63.41463	5277.436
	а				0.255			
	b	25 25.1	0.0075 0.0075	0.697 0.697	0.303	0.00424 0.005305	56.52798	
	С	25.1	0.0075	0.097	0.204	0.005305	70.73171	4731.494 5300
00.61.15			Elapsed Ti	me in Days	s = 17			
SB-91-12	00005							
	62089-1A							
	a	25.1	0.0075	0.697	0.229	0.005036		
	b	25	0.0075	0.697	0.269			
	С	25.1	0.0075	0.697	0.161	0.005768	76.901	4351.915

Elapsed Time in Days = 20

SB-91-12 62089-A	25.1 25	0.0075 0.0075	0.697 0.697		0.005649 0.004982	
	25.1	0.0075	0.697		0.006252	
	E	lapsed Tim	e in Days =	23		

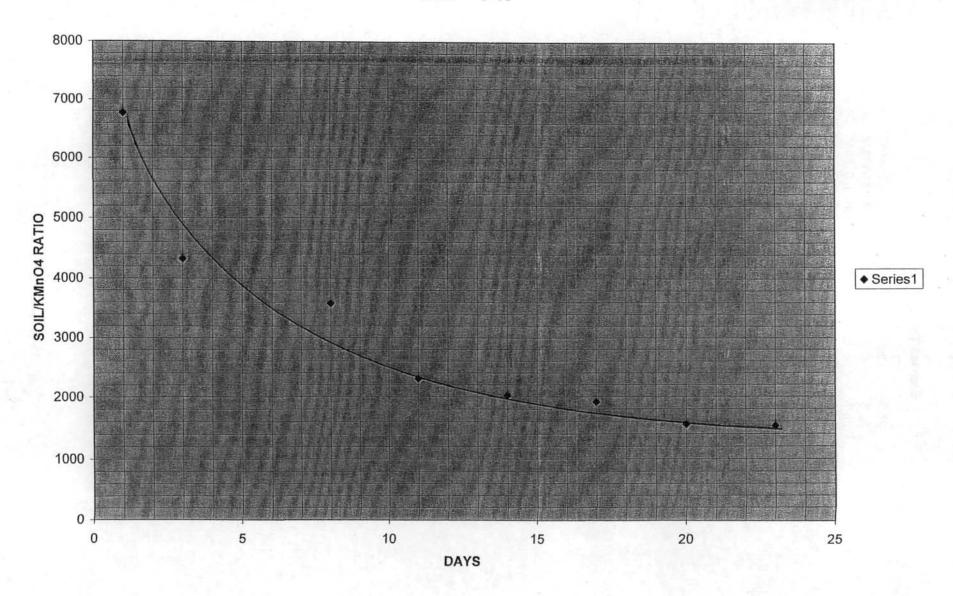
SB-91-12 62089-A 25.1 0.0075 0.697 0.168 0.005692 75.8967 4409.502 25 0.0075 0.697 0.231 0.005014 66.85796 4985.694 25.1 0.0075 0.697 0.133 0.006069 80.91822 4135.863 4510

Sample ID	Lab ID	Sample Weight	Initial Weight KMnO4	Initial Abs	Time T Abs	Weight KMnO4 Depleted	% of Initial KMnO4	Ratio Soil Wt./ KMn O4
			Flansed T	ime in Days	= =1			
Geo 5-16'	62089-2A		Liapscu	inic in Day.	5 – 1			
000 0 10	a	25.2	0.0075	0.697	0.424	0.002938	39.16786	8578.462
	b	25.5	0.0075	0.697		0.00396	52.7977	6439.674
	c	25.5	0.0075	0.697	0.249	0.004821	64.27547	
		20.0	0.0010	0.001	0.240	0.004021	01.21041	6770
								0//0
			Flansed T	ime in Days	= 3			
Geo 5-16'	62089-2A		Liupoou	illo ili Duy				
0000 10	a	25.2	0.0075	0.697	0.23	0.005025	67.00143	5014.818
	b	25.5	0.0075	0.697	0.136	0.006037	80.4878	4224.242
	C	25.5	0.0075	0.697	0.062	0.006833		3731.969
	Ü	20.0	0.0010	0.007	0.002	0.00000	01.10470	4320
								4320
			Flansed T	ime in Days	=8			
Geo 5-16'	62089-2A		Liupotu II	inc in Day.	, -0			
0000 10	a	25.2	0.0075	0.697	0.088	0.006553	87.37446	3845.517
	b	25.5	0.0075	0.697	0.017	0.007317	97.56098	3485
	C	25.5	0.0075	0.697	0.003	0.007468		3414.697
		20.0	0.00.0	0.007	0.000	0.001400	00.00000	3580
								0300
			Elapsed Ti	me in Days	=11			
Geo 5-16'	62089-2A		Liupoou ii	ino in Day				
	а	25.2	0.015	1.355	0.536	0.009066	60.4428	2779.487
	b	25.5	0.015	1.355	0.308	0.01159	77.26937	2200.096
	С	25.5	0.015	1.355	0.174	0.013074	87.15867	1950.466
								2300
			Elapsed Ti	me in Days	=14			
Geo 5-16'	62089-2A							
	а	25.2	0.015	1.355	0.411	0.01045	69.6679	2411.441
	b	25.5	0.015	1.355	0.14	0.01345	89.6679	
	С	25.5	0.015	1.355	0.038	0.014579	97.19557	1749.051
								2020
			Elapsed Ti	me in Days	= 17			
Geo 5-16'	62089-2A							
	а	25.2	0.015	1.355	0.334	0.011303	75.35055	2229.579
	b	25.5	0.015	1.355	0.059	0.014347	95.64576	1777.392
	С	25.5	0.015	1.355	0.013	0.014856	99.04059	1716.468
								1910

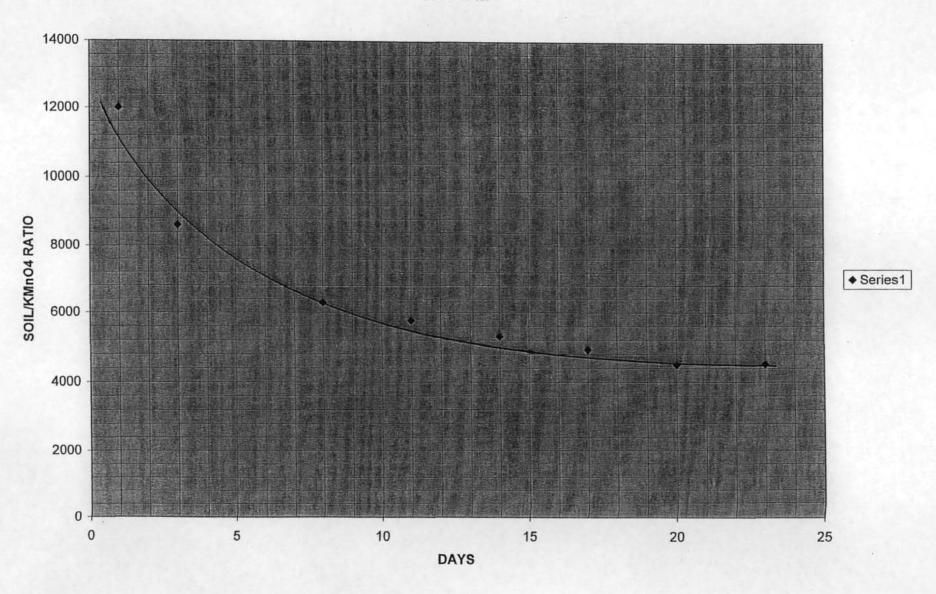
Elapsed Time in Days = 20	Elapsed	Time	in	Davs	= 20
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Geo 5-16'	62089-2A							
	а	25.2	0.02	1.772	0.529	0.014029	70.14673	1796.235
	b	25.5	0.02	1.772	0.277	0.016874	84.36795	1511.237
	C	25.5	0.02	1.772	0.106	0.018804	94.01806	1356.122
								1550
		Ela	psed Tim	e in Days =	23			
Geo 5-16'	62089-2A							
	а	25.2	0.02	1.772	0.579	0.013465	67.32506	1871.517
	b	25.5	0.02	1.772	0.165	0.018138	90.68849	1405.912
	С	25.5	0.02	1.772	0.021	0.019763	98.8149	1290.291

Geo 5-16'



SB 91-12'



APPENDIX H Permanganate Demand Calculations

APPENDIX H PERMANGANATE CONSUMPTION ESTIMATE

60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

SCENARIO: 9,500 cubic yards of impacts (160'x80x20')

PERMANGANATE REQUIRED TO TREAT SOIL

Unit	Permanganate Demand (moles/kg)	Soil Volume (cubic yards)	Soil Mass (kg)	Permanganate Required (moles)
Sand	0.0020	2,375.00	3,231,846	6,464
Silt	0.0034	7,125.00	9,695,538	32,965
		9,500.00		39,429

PERMANGANATE REQUIRED TO TREAT VOCS

VOC Mass (pounds)	Average VOC Molecular Weight (grams/mole)	VOC Mass (moles)	Permanganate Required (moles)
2,000	131.4	6,904	13,808

TOTAL PERMANGANATE REQUIRED TO TREAT SOIL AND VOCS

	SOLID	LIQUID							
Total Permanganate Required (moles)	Potassium Permanganate Required (pounds)	40% Sodium Permanganate Solution Required (pounds)	40% Sodium Permanganate Solution Required (gallons)						
53,237	18,552	41,652	3,654						

	Potassium	40% Sodium	40% Sodium
	Permanganate	Permanganate Solution	Permanganate Solution
SAFETY FACTOR	Required (pounds)	Required (pounds)	Required (gallons)
2	37,104	83,303	7,307
3	55,655	124,955	10,961
4	74,207	166,607	14,615
5	92,759	208,258	18,268

Assumptions:

- 1. 1.5 moles of oxidant produced for every mole of permanganate solution.
- 2. 3 moles of oxidant required to oxidize one mole of VOCs.
- 3. Molecular weight of TCE used to estimate average VOC molecular weight.
- 4. Soil density is 3,000 pounds per cubic yard.



CALCULATIONS BASED ON TYPICAL SOIL AND GROUND WATER VOC CONCENTRATIONS

Location	Depth (ft)	Strat Unit	Area (ft2)	Thickness (ft)	Volume (cubic feet)	cubic yards	Approx. Mass of soil (kg)	Typical Soil (ug/kg)	Ground Water volume - Liters (0.3 of soil)	Typical Groundwater (ug/L) - VOC	Mass in Soil (ug)	Mass in GW (ug)	Total Mass in Strata (ug)	Total VOC Mass in Strata (lbs)
Low Level Sand	0-6'	Sand	18,000	6	108,000	4,000	5,443,164	100	458,733	1,000	544,316,400	458,732,911	1,003,049,311	2.212
Low Level Silt	6-18	Silty Clay	18.000	12	216,000	8,000	10,886,328	100	1,834,932	1,000	1,088,632,800	1,834,931,646	2,923,564,446	6.446
Hot Spot (OL-2)	6-18'	Silty Clay	3,600	12	43,200	1,600	2,177,266	120,000	366,986	670,000	261,271,872,000	245,880,840,563	507,152,712,563	1,118.272
Hot Spot (MW-13)	6-18'	Silty Clay	1,500	12	18,000	667	907,194	23,000	152,911	140,000	20,865,462,000	21,407,535,870	42,272,997,870	93.212
	-					•		-				•		1,220,1

CALCULATIONS BASED ON MEAN SOIL AND GROUND WATER VOC CONCENTRATIONS

							Approx.		Ground Water	Mean				
	Depth			Thickness	Volume		Mass of soil	Mean Soil	volume - Liters	Groundwater			Total Mass in	Total VOC Mass
Location	(ft)	Strat Unit	Area (ft2)	(ft)	(cubic feet)	cubic yards	(kg)	(ug/kg)	(0.3 of soil)	(ug/L) • VOC	Mass in Soil (ug)	Mass in GW (ug)	Strata (ug)	in Strata (lbs)
Low Level Sand	0-6'	Sand	18,000	6	108,000	4,000	5,443,164	12	458,733	5	65,317,968	2,293,665	67,611,633	0.149
All Silt Layer	6-18	Silty Clay	18,000	12	216,000	8,000	10,886,328	25,000	1,834,932	10,000	272,158,200,000	18,349,316,460	290,507,516,460	640.569
Silt Levels (no Hot)	6-18	Silty Clay	18,000	12	216,000	8,000	10,886,328	3,086	1,834,932	10,000	33,595,208,208	18,349,316,460	51,944,524,668	114.538
All Hot Spots	6-18	Silty Clay	5,100	12	61,200	2,267	3,084,460	30,000	519,897	100,000	92,533,788,000	51,989,729,970	144,523,517,970	318.674
				,										
Hot Spot (OL-2)	6-18'	Silty Clay	3,600	12	43,200	1,600	2,177,266	34,000	366,986	670,000	74,027,030,400	245,880,840,563	319,907,870,963	705.397
Hot Spot (MW-13)	6-18'	Silty Clay	1,500	12	18,000	667	907,194	18,000	152,911	140,000	16,329,492,000	21,407,535,870	37,737,027,870	83.210
•		•												1.862.5

NOTES:

- 1. For background low levels, assume 3 feet unsaturated, and 3 feet saturated
- 2. Assumes 1.5 tons per cubic yard
- 3. Assumes porosity is 30%

APPENDIX I Cost Estimates for Remedial Alternatives

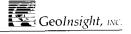
60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 1A: Soil Excavation with Off-Site Disposal

With Estimated Costs for Off-Site Treatment and Disposal

Estin	nated Costs			
Item	Units	Quantity	Unit Cost	Estimated Total
Preparation				
Health and Safety Plan	LS	1	\$ 5,000.00	\$ 5,000
Mobilization/Demobilization	LS	1	\$ 5,000.00	\$ 5,000
Site Preparation and Tree Clearing	LS	1	\$ 10,000.00	\$ 10,000
Silt Fencing/Wetland Controls	LS	1	\$ 5,000.00	\$ 5,000
Road and Bridge Upgrade	LS	1	\$ 10,000.00	\$ 10,000
Sheet Pile Wall				
Sheet Pile Installation (800 LF to 15 FT BGS)	LUMP	1	\$ 115.500.00	\$ 115,500
Additional Shoring (120 LF to divide area)	FT	120	\$ 225.00	\$ 27,000
Sheet Pile Installation Oversight	DAY	6	\$ 500.00	\$ 3,000
Excavation				
Pre-characterization sampling (23 borings)	DAY	3	\$ 1,200.00	\$ 3,600
Pre-characterization analyses	SAMPLE	20	\$ 500.00	\$ 10,000
Pre-characterization oversight	DAY	3	\$ 1,000.00	\$ 3,000
Equipment Mobilization/Demobilization	LS	1	\$ 30,000.00	\$ 30,000
Excavation and Handling (1)	TON	14.250	\$ 10.00	\$ 142,500
Environmental Oversight	DAY	40	\$ 1,000.00	\$ 40,000
Post-Excavation Soil Sample Collection	DAY	15	\$ 600.00	\$ 9,000
Soil Sample Analysis	SAMPLE	240	\$ 100.00	\$ 24,000
Dewatering				
Dewatering Equipment (Frac tank, pumps, etc.)	DAY	40	\$ 1,500.00	\$ 60,000
Carbon Change (2)	POUND	8000	\$ 1.60	\$ 12,800
Off-Site Treatment and Disposal				
Transportation (3), (4)	TRIP	475	\$ 1,350.00	\$ 641,250
Disposal at Permitted Facility (5)	TON	14,250	\$ 200.00	\$ 2,850,000
Disposar at 1 cirimited 1 deinty (5)		14,200	200.00	2,000,000
Monitoring & Compliance Well Installation Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$ 1,250.00	\$ 18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5		
, ,	DAI	5	\$ 1,000.00	\$ 5,000
Post-Treatment Ground Water Sampling (3 years)				
Ground Water Sampling (15 wells)	EVENT	12	\$ 2,500.00 \$ 150.00	\$ 30,000
Ground Water Sample Analysis (6)	SAMPLE	180	\$ 150.00	\$ 27,000
Site Restoration		44		
Clean Fill	TON	14,250	\$ 15.75	\$ 224,438
Site Clean Up and Demobilization	LS	1	\$ 5,000.00	\$ 5,000
			Subtotal:	\$ 4,316,088
			Engineering:	
		Cont		
			ingency (10%):	\$ 436,609
			tal (Rounded):	\$ 4,803,000

- 1. Assumes a soil density of 1.5 tons per cubic yard (9,500 cy = 14,250 tons), soil handling estimate by Cyn.
- 2. Carbon cost assumes a 1% by weight adsorption rate for VOCs (80 pounds VOCs adsorbed)
- 3. Soil Transportation and Disposal by Specialty Waste Services, Inc.
- 4. Assumes trucks can carry 30 tons per load.
- 5. Soil is disposed as a non-hazardous waste material (<50 ppm CVOCs)
- 6. 15 ground water samples will be collected during each ground water sampling event.



60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 1B: Soil Excavation with On-Site Stabilization

Solidification and stabilization using asphalt emulsion and portland cement

	stimated Co	sts				
Item	Units	Quantity		Unit Cost	Est	imated Total
Preparation			1 -			
Health and Safety Plan	LS	1	\$	5,000.00	\$	5,000
Mobilization/Demobilization	LS	1	\$	5,000.00	\$	5,000
Site Preparation and Tree Clearing	LS	1	\$	10,000.00	\$	10,000
Silt Fencing/Wetland Controls	LS	1	\$	5,000.00	\$	5,000
Road and Bridge Upgrade	LS	1	\$	10,000.00	\$	10,000
Sheet Pile Wall			İ		!	
Sheet Pile Installation (800 LF to 15 FT BGS)	LUMP	l 1	\$	115,500.00	\$	115,500
Additional Shoring (120 LF to divide area)	FT	120	\$	225.00	\$	27,000
Sheet Pile Installation Oversight	DAY	6	\$	500.00	\$	3,000
Excavation		:				
Excavation and Handling (1)	TON	14,250	\$	20.00	\$	285,000
Environmental Oversight	DAY	60	\$	1,000.00	\$	60,000
Equipment Mobilization/Demobilization	LS	1	\$	30,000.00	\$	30,000
Post-Excavation Soil Sample Collection	DAY	15	\$	600.00	\$	9,000
Soil Sample Analysis	SAMPLE	240	\$	100.00	\$	24,000
Dewatering			1			
Dewatering Equipment (Frac tank, pumps, etc.)	DAY	60	\$	1,500.00	\$	90,000
Carbon Change (2)	POUND	8000	\$	1.60	\$	12,800
On-Site Stabilization						
Stabilization (3)	TON	14,250	\$	60.00	\$	855,000
Monitoring & Compliance Well Installation		1	1	İ		
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$	1,250.00	\$	18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$	1,000.00	\$	5,000
Post-Treatment Ground Water Sampling (3 years)						
Ground Water Sampling (15 wells)	EVENT	12	\$	2,500.00	\$	30,000
Ground Water Sample Analysis (4)	SAMPLE	180	\$	150.00	\$	27,000
Site Restoration					i)	
Site Clean Up and Demobilization	LS	1	\$	5,000.00	\$	5,000
				Subtotal:	\$	1,631,300
				Engineering:	\$	50,000
			Cont	ingency (10%):	\$	168,130
				otal (Rounded):	\$	1,849,000

- 1. Assumes a soil density of 1.5 tons per cubic yard (9,000 cy = 14,250 tons)
- 2. Carbon cost assumes a 1% by weight adsorption rate for VOCs (80 pounds VOCs adsorbed)
- 3. United Retek quoted \$40 to \$60 per ton. Treatment at \$40/ton = \$660,000.
- 4. 15 ground water samples will be collected during each ground water sampling event.



60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 2A: Soil Mixing and Permanganate Injection Using Earth Augers

Esti	mated Costs		_			
ltem	Units	Quantity		Unit Cost		Estimated Total
Preparation						
Health and Safety Plan	LS	1	\$	5,000.00	\$	5,000
Mobilization/Demobilization	LS	1	\$	5,000.00	\$	5,000
Site Preparation and Tree Clearing	LS	1	\$	10,000.00	\$	10,000
Silt Fencing/Wetland Controls	LS	1	\$	5,000.00	\$	5,000
Road and Bridge Upgrade	LS	1	\$	10,000.00	\$	10,000
Earth Auger Mixing			ļ			
Mobilization	LS	1	\$	150,000.00	\$	150,000
Bentonite/Cement Wall	LS	1	\$	120,000.00	\$	120,000
Soil Mixing (1, 2)	CY	9,500	\$	65.00	\$	617,500
Environmental Oversight	DAY	55	\$	1,000.00	\$	55,000
40 hour - OSHA for crew	LS	1	\$	2,500.00	\$	2,500
Permanganate						
Potassium Permanganate (3)	POUND	92,760	\$	2.00	\$	185,520
Water Supply Coordination	LS	1	\$	2,500.00	\$	2,500
Treatment Monitoring during Implementation (3)						
Field GC (operator, standards, sample prep)	DAY	30	\$	300.00	\$	9,000
GeoProbe Drill Rig with oversight	DAY	30	\$	2,000.00	\$	60,000
Ground Water Sample Analysis (lab confirmation (3 per day)	SAMPLE	90	\$	100.00	\$	9,000
Monitoring & Compliance Well Installation			l			
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$	1,250.00	\$	18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$	1,000.00	\$	5,000
Post-Treatment Ground Water Sampling (3 years)					ı	
Ground Water Sampling (15 wells)	EVENT	12	\$	2,500.00	\$	30,000
Ground Water Sample Analysis (5)	SAMPLE	180	\$	150.00	\$	27,000
Site Restoration						
Site Clean Up and Demobilization	LS	1	\$	5,000.00	\$	5,000
	<u> </u>	<u> </u>	<u> </u>	Subtotal:	\$	1,331,020
			ı	Engineering:	\$	50,000
		Co	nting	gency (10%):	\$	138,102
			Tota	I (Rounded):	\$	1,519,000

- 1. Approximately 420 boreholes will be advanced in the impacted area.
- 2. Soil mixing contractor will handle permanganate powder and create slurry for injection
- 3. 5X Permanganate Safety Factor (18,552 pounds x 5 = 92,760 pounds); cost for 4X safety factor = \$148,420 (74,210 pounds)
- 4. Post-excavation ground water samples collected from two depths from selected auger footprints.
- 5. 15 ground water samples will be collected during each ground water sampling event.



60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 2B: Sodium Permanganate Injection

Inject sodium permanganate within FDDA

Estimate	d Costs				
ltem	Units	Quantity	Unit Cost	Esti	mated Total
Preparation					
Health and Safety Plan	LS	1	\$ 5,000.00	\$	5,000
Mobilization/Demobilization	LS	1	\$ 5,000.00	\$	5,000
Site Preparation and Tree Clearing	LS	1	\$ 10,000.00	\$	10,000
Silt Fencing/Wetland Controls	LS	1	\$ 5,000.00	\$	5,000
Road and Bridge Upgrade	LS	1	\$ 10,000.00	\$	10,000
njection System Components			1	ĺ	
Drilling and Injection Well Materials 4" Wells	WELL	45	\$ 750.00	S	33,750
Drilling Oversight (1)	DAY	12	\$ 1,000.00	\$	12,000
Excavation and materials for Horizontal Trenches	DAY	5	\$ 1,500.00	\$	7,500
Excavation Oversight (Trenches)	DAY	5	\$ 700.00	\$	3,500
Above Ground Distribution System Materials	LS	1	\$ 10,000.00	\$	10,000
Installation of Injection System - labor	DAY	5	\$ 3,000.00	\$	15,000
Permanganate Injection	1 1		1		
Delivery System (pumps, mixing tank)	LS	1	\$ 10,000	S	10,000
40% Sodium Permanganate (2)	POUND	166,608	\$ 2.50	\$	416,520
Injection Events (1,000 gallons or 11,400 pounds per event)	EVENT	13	\$ 10,000.00	\$	130,000
Site Monitoring (once between injections)	VISIT	13	\$ 2,500.00	l š	32,500
Ground Water Sample Analysis (3)	SAMPLE	130	\$ 150.00	\$	19,500
Monitoring & Compliance Well Installation			1		
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$ 1,250.00	\$	18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$ 1,000.00	\$	5,000
Post-Treatment Ground Water Sampling (3 years)	1		1		
Ground Water Sampling (15 wells)	EVENT	12	\$ 2,500.00	S	30,000
Ground Water Sample Analysis (4)	SAMPLE	180	\$ 150.00	\$	27,000
Site Restoration					
Site Clean Up and Demobilization	LS	1	\$ 5,000.00	\$	5,000
			Subtotal:	\$	810,270
			Engineering:	\$	50,000
		Cont	ingency (10%):	\$	86,027
			tal (Rounded):	\$	946,000

- 1. Assumes 4 wells installed per day.
- 2. 4X Permanganate Safety Factor (41,652 pounds x 4 = 166,608 pounds).
- 3. 10 ground water samples collected during each monitoring event (between injections).
- 4. 15 ground water samples will be collected during each ground water sampling event.



60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 2C: Sodium Permanage Injection and Recirculation

Inject sodium permanganate and recirculate solution using extraction/injection system

	Estim	ated Costs		
Item	Units	Quantity	Unit Cost	Estimated Total
reparation				
Health and Safety Plan	LS	1	\$5,000.00	\$5,000
Mobilization/Demobilization	LS	1	\$5,000.00	\$5,000
Site Preparation and Tree Cleaning	l LS	1	\$10,000.00	\$10,000
Silt Fencing/Wetland Controls	LS	1	\$5,000.00	\$5,000
Road and Bridge Upgrade	LS	1	\$10,000.00	\$10,000
njection and Recirculation System			[
Drilling and Injection Well Materials 4" Wells	WELL	45	\$750.00	\$33,750
Drilling Oversight (1)	DAY	12	1 ' ' ' ' ' '	• •
			\$1,000.00	\$12,000
Excavation and materials for Horizontal Trenches	DAY	5	\$1,500.00	\$7,500
Excavation Oversight (Trenches)	DAY	5	\$700.00	\$3,500
Above Ground Distribution System Materials	LS	1	\$10,000.00	\$10,000
Installation of Injection System - labor	DAY	5	\$3,000.00	\$15,000
Drilling Recovery Wells Materials 6" Wells	WELL	5	\$1,200.00	\$6,000
Environmental Oversight	DAY	3	\$1,000.00	\$3,000
Permanganate Injection			1	
Delivery System (pumps, mixing tank)	LS	1	\$10,000.00	\$10,000
40% Sodium Permanganate (2)	POUND	124,956 to 166,608	\$2.50	\$312,390 to \$416,520
Injection Events (1,000 gallons or 11,400 pounds per event)	EVENT	10 to 13	\$10,000.00	\$100,000 to \$130,000
Site Monitoring (once between injections)	VISIT	10 to 13	\$2,500.00	\$25,000 to \$32,500
Ground Water Sample Analysis (4)	SAMPLE	100 to 130	\$150.00	\$15,000 to \$19,500
Recirculation System				
Recirculation System (trailer, pumps, tank, piping)	l LS	1	\$20,000.00	\$20,000
Energy Consumption (2 years @ 5 hp)	кwн	65,323	\$0.15	\$9.798
System Operation and Monitoring (3)	VISIT	36	\$1,000.00	\$36,000
• • • • • • • • • • • • • • • • • • • •	''.5.1'	30	\$1,000.00	930,000
Monitoring & Compliance Well Installation			l }	
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$1,250.00	\$18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$1,000.00	\$5,000
Post-Treatment Ground Water Sampling (3 years)				
Ground Water Sampling (15 wells)	EVENT	12	\$2,500.00	\$30,000
Ground Water Sample Analysis (5)	SAMPLE	180	\$150.00	\$27,000
ite Restoration	1			
Site Clean Up and Demobilization	l LS	1	\$5,000.00	\$5,000
		·	L	
			Subtotal: Engineering:	\$738,938 to \$885,068 \$50,000 to \$50,000
		Conti	ngency (10%):	\$78,894 to \$93,507
			tal (Rounded):	\$868,000 to \$1,029,000

- 1. Assumes 4 wells installed per day.
 2. Uses 3X and 4X permanganate safety factor (124,956 pounds to 166,608 pounds)
- 3. System monitoring events are for recirculation system operation and maintenance (assume monthly for three years)
- 4. 10 ground water samples collected during each monitoring event (between injections).
- 5. 15 ground water samples collected during each ground water sampling event.

60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 2D: Sheet Pile Wall and Permanganate Injection

Install sheet pile wall around FDDA and inject sodium permanganate

	Estimated			
Item	Units	Quantity	Unit Cost	Estimated Total
reparation				
Health and Safety Plan	LS ;	1	\$5,000.00	\$5,000
Mobilization/Demobilization	LS	1	\$5,000.00	\$5,000
Site Preparation and Tree Clearing/Electrical	LS	1	\$10,000.00	\$10,000
Silt Fencing/Wetland Controls	LS	1	\$5,000.00	\$5,000
Road and Bridge Upgrade	LS	1	\$10,000.00	\$10,000
3-4 foot trench - sheet pile prep	LS	1	\$1,200.00	\$1,200
Sheet Pile Wall				
Sheet Pile & Sealing - 600 LF X 20FT BGS	LUMP	1 1	\$110,000.00	\$110,000
Sheet Pile Installation and Sealing Oversight	DAY	10	\$700.00	\$7,000
njection System				
Drilling and Injection Well Materials 4" Wells	WELL	45	\$750.00	\$33,750
Drilling Oversight (1)	DAY	12	\$1,000.00	\$12,000
Excavation and materials for Horizontal Trenches	DAY	5	\$1,500.00	\$7.500
Excavation Oversight (Trenches)	DAY	5	\$700.00	\$3,500
Above Ground Distribution System Materials	LS	1	\$10,000.00	\$10,000
Installation of Injection System - labor	DAY	5	\$3,000.00	\$15,000
harman manada Inicadia -				
Permanganate Injection			*** ***	\$10.000
Delivery System (pumps, mixing tank)	LS POUND	1	\$10,000.00	\$10,000
40% Sodium Permanganate (2)		83,304 to 166,608		\$208,260 to \$416,520
Injection Events (1,000 gallons or 11,400 pounds per event)		7 to 13	\$10,000.00	\$70,000 to \$130,000
Site Monitoring (once between injections)	VISIT	7 to 13	\$2,500.00	\$17,500 to \$32,500
Ground Water Sample Analysis (3)	SAMPLE	70 to 130	\$150.00	\$10,500 to \$19,500
fonitoring & Compliance Well Installation				
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$1,250.00	\$18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$1,000.00	\$5,000
ost-Treatment Ground Water Sampling (3 years)			İ	
Ground Water Sampling (15 wells)	EVENT	12	\$2,500.00	\$30,000
Ground Water Sample Analysis (4)	SAMPLE	180	\$150.00	\$27,000
ite Restoration				
Site Clean Up and Demobilization	LS	1	\$5,000.00	\$5,000
			0	#COC 040 A- #000 470
			Subtotal:	\$636,210 to \$928,470
		Ca-4!-	Engineering:	\$50,000 to \$50,000 \$68,631 to \$07,947
		Contil	ngency (10%): Total:	\$68,621 to \$97,847 \$755,000 to \$1,076,000

- Assumes 4 wells per day.
 Uses 2X to 4X permanganate safety factor (83,304 pounds to 166,608 pounds)
 10 ground water samples collected during each monitoring event (between injections).
 15 ground water samples collected during each ground water sampling event.



60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 2E: Sheet Pile Wall, Permanganate Injection, and Recirculation

Install sheet pile wall around FDDA, inject sodium permanganate, and recirculate

	Estir	nated Costs		
Item	Units	Quantity	Unit Cost	Estimated Total
reparation				
Health and Safety Plan	LS	1 1	\$5,000.00	\$5,000
Mobilization/Demobilization	LS	1	\$5,000.00	\$5,000
Site Preparation and Tree Clearing	l Ls l	1 1	\$10,000.00	\$10,000
Silt Fencing/Wetland Controls	l Ls l	1 !	\$5,000.00	\$5.000
Road and Bridge Upgrade	LS	1	\$10,000.00	\$10,000
3-4 foot trench - sheet pile prep	LS	i	\$1,200.00	\$1,200
heet Pile Wall				
Sheet Pile & Sealing - 600 LF X 20FT BGS	LUMP	1 1	\$110,000.00	\$110,000
Sheet Pile Installation and Sealing Oversight	DAY	10	\$700.00	\$7,000
njection and Recirculation System				
Drilling and Injection Well Materials 4" Wells	WELL	45	\$750.00	\$33,750
Drilling Oversight (1)	DAY	12	\$1,000.00	\$12,000
	DAY		\$1,000.00	
Excavation and materials for Horizontal Trenches		5		\$7,500 \$0,500
Excavation Oversight (Trenches)	DAY	5	\$700.00	\$3,500
Above Ground Distribution System Materials	LS	1	\$10,000.00	\$10,000
Installation of Injection System - labor	DAY	5	\$3,000.00	\$15,000
Drilling Recovery Wells Materials 6" Wells	WELL	5	\$1,200.00	\$6,000
Environmental Oversight	DAY	3	\$1,000.00	\$3,000
ermanganate injection				
Delivery System (pumps, mixing tank)	LS	1	\$10,000.00	\$10,000
40% Sodium Permanganate (2)	POUND	83,304 to 166,608	\$2.50	\$208,260 to \$416,520
Injection Events (1,000 gallons or 11,400 pounds per event)	EVENT	7 to 13	\$10,000.00	\$70,000 to \$130,000
Site Monitoring (once between injections)	VISIT	7 to 13	\$2,500.00	\$17,500 to \$32,500
Ground Water Sample Analysis (3)	SAMPLE	70 to 130	\$150.00	\$10,500 to \$19,500
ecirculation System				
Recirculation System (trailer, pumps, tank, piping)	l LS	1	\$20,000.00	\$20,000
Energy Consumption (2 year @ 5 hp)	kwh !	65,323	\$0.15	\$9.798
System Monitoring (2 years, monthly) (4)	VISIT	24	\$1,000.00	\$24,000
cot Treatment Overand Water Compliant (Overan)	1			
ost-Treatment Ground Water Sampling (3 years)	=\/_\	46	#0 F00 00	#00.000
Ground Water Sampling (15 wells)	EVENT	12	\$2,500.00	\$30,000
Ground Water Sample Analysis (5)	SAMPLE	180	\$150.00	\$27,000
Ionitoring & Compliance Well Installation				
Monitoring Wells - 1° PVC, clusters (3 wells each)	CLUSTER	15	\$1,250.00	\$18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$1,000.00	\$5,000
ite Restoration			}	
Site Clean Up and Demobilization	LS	1	\$5,000.00	\$5,000
			Subtotal:	\$699,008 to \$991,268
			Engineering:	\$50,000 to \$50,000
			ngency (10%):	\$74,901 to \$104,127
		То	tal (Rounded):	\$824,000 to \$1,145,000

- Assumes 4 wells installed per day.
 Uses 2X to 4X permanganate safety factor (83,304 pounds to 166,608 pounds)
- 10 ground water samples collected during each monitoring event (between injections).
 System monitoring events are for recirculation system operation and maintenance.
- 5. 15 ground water samples collected during each ground water sampling event.

60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 3A: Ex-Situ Permanganate Addition and Treatment

Excavation, mixing soil with permanganate in pugmill, and replacing soil in excavation

Estimated Costs						
ltem	Units	Quantity		Unit Cost	Es	timated Total
Preparation						
Health and Safety Plan	LS	1	\$	5,000.00	\$	5,000
Mobilization/Demobilization	LS	1	\$	5,000.00	\$	5,000
Site Preparation and Tree Clearing	LS	1	\$	10,000.00	\$	10,000
Silt Fencing/Wetland Control	LS	1	\$	5,000.00	\$	5,000
Road and Bridge Upgrade	LS	1	\$	10,000.00	\$	10,000
Sheet Pile Wall						
Sheet Pile Installation (800 LF to 15 FT BGS)	LUMP	1	\$	115,500.00	\$	115,500
Additional Shoring (120 LF to divide area)	FT	120	\$	225.00	\$	27,000
Sheet Pile Installation Oversight	DAY	6	\$	500.00	\$	3,000
Excavation						
Excavation and Handling (1)	TON	14,250	\$	20.00	\$	285,000
Equipment Mobilization/Demobilization	LS	1	\$	30.000.00	\$	30,000
Environmental Oversight	DAY	60	\$	1,000.00	\$	60,000
Post-Excavation Soil Sample Collection	HOUR	120	\$	75.00	\$	9,000
Soil Sample Analysis	SAMPLE	240	\$	100.00	\$	24,000
Dewatering						
Dewatering and Treatment	DAY	60	 \$	1,500.00	\$	90,000
Carbon Change (2)	POUND	8000	\$	1.60	\$	12,800
Ex-Situ Permanganate Addition						
Potassium Permanganate (3)	POUND	92,760	\$	2.00	\$	185,520
1 olassiam i emanganate (5)	FOUND	92,700	*	2.00	Ψ	100,020
Monitoring & Compliance Well Installation	OLUGTED	45		4.050.00		40.000
Monitoring Wells - 1" PVC, clusters (3 wells each)		15	\$	1,250.00	\$	18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$	1,000.00	\$	5,000
Post-Treatment Ground Water Sampling (3 years)						
Ground Water Sampling (15 wells)	EVENT	12	\$	2,500.00	\$	30,000
Ground Water Sample Analysis (4)	SAMPLE	180	\$	150.00	\$	27,000
Site Restoration						
Site Clean Up and Demobilization	LS	1	\$	5,000.00	\$	5,000
	<u></u>			Subtotal:	\$	961,820
				Engineering:	\$	50,000
		Co		gency (10%):	\$	101,182
			Tota	I (Rounded):	\$	1,113,000

- 1. Assumes a soil density of 1.5 tons per cubic yard (9,500 cy = 14,250 tons)
- 2. Carbon cost assumes a 1% by weight adsorption rate for VOCs (80 pounds VOCs adsorbed)
- 3. 5X Permanganate Safety Factor (16,146 pounds x 5 = 80,729 pounds); costs for 4X safety factor (74,210 pounds) = \$148,420.
- 4. 15 ground water samples collected during each ground water sampling event.

60 OLYMPIA AVENUE **WOBURN, MASSACHUSETTS**

ALTERNATIVE 3B: Targeted Excavation Followed by Permanganate Addition

Targeted excavation of hot spots (1/4 of FDDA), followed by permanganate injection (3/4 of FDDA).

Item	5,000 5,000 10,000 5,000 10,000 79,750 1,500
Health and Safety Plan	5,000 10,000 5,000 10,000
Mobilization/Demobilization LS	5,000 10,000 5,000 10,000
Site Preparation and Tree Clearing LS 1 \$ 10,000.00 \$ Silt Fencing/Wetland Control LS 1 \$ 5,000.00 \$ Road and Bridge Upgrade LS 1 \$ 5,000.00 \$ Road and Bridge Upgrade LS 1 \$ 10,000.00 \$ Sheet Pile Wall (Limited Area) Sheet Pile Installation (55' x 90' to 15' BGS) FT 290 \$ 275.00 \$ Sheet Pile Installation Oversight DAY 3 \$ 500.00 \$ Excavation Excavation and Handling (1) TON 3,563 \$ 10.00 \$ Environmental Oversight DAY 10 \$ 1,000.00 \$ Equipment Mobilization/Demobilization LS 1 \$ 30,000.00 \$ Post-Excavation Soil Sample Collection DAY 4 \$ 600.00 \$ Soil Sample Analysis SAMPLE 60 \$ 100.00 \$ Dewatering Dewatering Equipment (Frac tank, pumps, etc.) DAY 10 \$ 1,500.00 \$ Carbon Change (2) POUND 2000 \$ 1.60 \$ Off-Site Treatment and Disposal (3) Pre-characterization sampling (23 borings) DAY 1 \$ 1,200.00 \$ Pre-characterization versight DAY 1 \$ 1,000.00 \$ Transportation (4) TRIP 119 \$ 1,350.00 \$ Disposal at Permitted Facility TON 3,563 \$ 200.00 \$ Injection System Drilling and Injection Well Materials 4" Wells WELL 25 \$ 750.00 \$ Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	10,000 5,000 10,000 79,750
Silt Fencing/Wetland Control Road and Bridge Upgrade	5,000 10,000 79,750
Road and Bridge Upgrade	10,000 79,750
Sheet Pile Wall (Limited Area) Sheet Pile Installation (55' x 90' to 15' BGS) FT 290 \$ 275.00 \$ Sheet Pile Installation Oversight DAY 3 \$ 500.00 \$	79,750
Sheet Pile Installation (55' x 90' to 15' BGS) FT	
Sheet Pile Installation (55' x 90' to 15' BGS) FT	
Excavation Excavation and Handling (1) TON 3,563 \$ 10.00 \$	
Excavation and Handling (1)	
Excavation and Handling (1)	
Environmental Oversight Equipment Mobilization/Demobilization LS 1 \$ 30,000.00 \$ \$ \$ \$ \$ \$ \$ \$ \$	35,630
Equipment Mobilization/Demobilization	10,000
Day	30,000
Dewatering Dewatering Equipment (Frac tank, pumps, etc.) DAY 10 \$ 1,500.00 \$	
Dewatering Dewatering Equipment (Frac tank, pumps, etc.) DAY 10 \$ 1,500.00 \$ \$ \$ \$ \$ \$ \$ \$ \$	2,400
Dewatering Equipment (Frac tank, pumps, etc.) DAY 10 \$ 1,500.00 \$	6,000
Carbon Change (2) POUND 2000 \$ 1.60 \$ Off-Site Treatment and Disposal (3) Pre-characterization sampling (23 borings) DAY 1 \$ 1,200.00 \$ Pre-characterization analyses SAMPLE 6 \$ 500.00 \$ Pre-characterization oversight DAY 1 \$ 1,000.00 \$ Transportation (4) TRIP 119 \$ 1,350.00 \$ Disposal at Permitted Facility TON 3,563 \$ 200.00 \$ Injection System Drilling and Injection Well Materials 4" Wells WELL 25 \$ 750.00 \$ Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	18.0
Off-Site Treatment and Disposal (3) Pre-characterization sampling (23 borings) Pre-characterization analyses Pre-characterization oversight DAY 1 \$ 1,200.00 \$ Pre-characterization oversight DAY 1 \$ 1,000.00 \$ Transportation (4) Transportation (4) Disposal at Permitted Facility TON 3,563 \$ 200.00 \$ Injection System Drilling and Injection Well Materials 4" Wells Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	15,000
Pre-characterization sampling (23 borings) DAY 1 \$ 1,200.00 \$ 500.00 \$ 500.00 \$ 500.00 \$ 500.00 \$ 500.00 \$ 500.00 \$ 500.00 \$ 1,0	3,200
Pre-characterization analyses SAMPLE 6 \$ 500.00 \$ 700.00 \$ 1,000.00 \$ 1,000.00 \$ 1,000.00 \$ 1,000.00 \$ 1,000.00 \$ 1,350.00 \$ 1,350.00 \$ 1,350.00 \$ 1,350.00 \$ 1,000.00 \$ 1,0	
Pre-characterization oversight	1,200
Pre-characterization oversight	3,000
Transportation (4)	1,000
Disposal at Permitted Facility TON 3,563 \$ 200.00 \$ Injection System Drilling and Injection Well Materials 4" Wells Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	160,335
Drilling and Injection Well Materials 4" Wells WELL 25 \$ 750.00 \$ Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	712,600
Drilling and Injection Well Materials 4" Wells WELL 25 \$ 750.00 \$ Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	
Drilling Oversight (asssumes 4 wells per day) DAY 6 \$ 1,000.00 \$	18,750
	6,000
I EXCAVATION AND MATERIALS FOR HONZONIAL FRENCHES (1) I DAY I 4 IN LABORATION IN	•
	6,000
Excavation Oversight (Trenches) Above Crowd Pictribution System Materials DAY 4 \$ 700.00 \$	2,800
Above Ground Distribution System Materials LS 1 \$ 10,000.00 \$ Installation of Injection System - labor DAY 5 \$ 3,000.00 \$	10,000 15,000
	•
Permanganate Injection	
Delivery System (pumps, mixing tank) LS 1 \$ 10,000 \$	10,000
40% Sodium Permanganate POUND 124,956 \$ 2.50 \$	312,390
Injection Events	100,000
Site Monitoring (once between injections) VISIT 10 \$ 1,000.00 \$	10,000
Ground Water Sample Analysis (10 samples per event) SAMPLE 100 \$ 100.00 \$	10,000
Monitoring & Compliance Well Installation	
Monitoring Wells - 1" PVC, clusters (3 wells each) CLUSTER 15 \$ 1,250.00 \$	18,000
Monitoring Wells 12 1" PVC (Oversight) DAY 5 \$ 1,000.00 \$	5,000
Post-Treatment Ground Water Sampling (3 years)	
Ground Water Sampling (15 wells) EVENT 12 \$ 2,500.00 \$	30,000
Ground Water Sample Analysis (6) SAMPLE 180 \$ 150.00 \$	27,000
Site Restoration	
Clean Fill TON 3,563 \$ 15.75 \$	56,117
Site Clean Up and Demobilization LS 1 \$ 5,000.00 \$	5,000
	1 700 0=0
Subtotal: \$ Engineering: \$	1,738,672
Contingency (10%): \$	
Total (Rounded): \$	50,000 178,867

- Assumes a soil density of 1.5 tons per cubic yard (9,500 cy x 0.25 = 2,375 cy = 3,563 tons)
 Carbon cost assumes a 1% by weight adsorption rate for VOCs (20 pounds VOCs adsorbed)
- 3. Soil Transportation and Disposal by Specialty Waste Services, Inc.
- 4. Assumes trucks can carry 30 tons per load.
 5. 4X Permanganate Safety Factor for 75% of area (41,652 pounds x 4 = 166,607 pounds; 0.75 x 166607 = 124,956).
- 6. 15 ground water samples collected during each ground water sampling event.

60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 3C: Targeted Soil Mixing Using Earth Augers (4,750 CY) and Permanganate Injection

Earth auger mixing (1/2 of FDDA), followed by permanganate injection (1/2 of FDDA).

Estimated Costs						
ltem	Units	Quantity		Unit Cost	Est	imated Total
Preparation						
Health and Safety Plan	LS	1	\$	5,000.00	\$	5,000
Mobilization/Demobilization	LS	1	\$	5,000.00	\$	5,000
Site Preparation and Tree Clearing	LS	1	 \$	10,000.00	 \$	10,000
Silt Fencing/Wetlands Protection	LS	1	\$	5,000.00	\$	5,000
Road and Bridge Upgrade	LS	1	\$	10,000.00	\$	10,000
 Earth Auger Mixing	,	ļ				
Mobilization	LS	1	\$	150,000.00	\$	150,000
Soil Mixing (half of area)	CY	4.750	\$	65.00	\$	308,750
Environmental Oversight	DAY	35	\$	1,000.00	\$	35,000
40 hour - OSHA for crew	LS	1	\$	2,500.00	\$	2,500
Permanganate (soil mixing)	}				}	
Potassium Permanganate (1)	POUND	46,380	\$	2.00	\$	92,760
Water Supply Coordination	LS	1	\$	2,500.00	\$	2,500
Injection Well Installation System	<u> </u>					
Drilling and Injection Well Materials 4" Wells (2)	WELL	25	\$	750.00	\$	18,750
Drilling Oversight (2)	DAY	6	\$	1,000.00	\$	6,000
Barrier and the said						
Permanganate Injection			_	T 000	ĺ _	0.500
Delivery System (pumps, mixing tank)	LS	1	\$	5,000	\$	2,500
40% Sodium Permanganate (3)	POUND	83,304	\$	2.50	\$	208,260
Injection Events	EVENT	7	\$	10,000.00	\$	70,000
Site Monitoring (once between injections)	VISIT	7	\$	1,000.00	\$	7,000
Ground Water Sample Analysis (4)	SAMPLE	70	\$	150.00	\$	10,500
Monitoring & Compliance Well Installation	}		}			
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$	1,250.00	\$	18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$	1,000.00	\$	5,000
Post-Treatment Ground Water Sampling (3 years)						
Ground Water Sampling (15 wells)	EVENT	12	\$	2,500.00	\$	30,000
Ground Water Sample Analysis (5)	SAMPLE	180	\$	150.00	\$	27,000
Site Restoration		:				
Site Clean Up and Demobilization	LS	1	\$	5,000.00	\$	5,000
		<u> </u>	 -	Subtotal:	\$	1,034,520
				Engineering:	\$	50,000
		Co		jency (10%):	\$	108,452
			Total	(Rounded):	\$	1,193,000

- 1. 5X Permanganate Safety Factor for half of the impacted area (18,552 pounds \times 0.5 \times 5 = 46,380 pounds).
- 2. Assumes 4 wells installed per day.
- 3. 4X Permanganate Safety Factor for half of the impacted area $(41,652 \text{ pounds } \times 0.5 \times 4 = 83,304 \text{ pounds})$.
- 4. 10 ground water samples collected during each monitoring event (between injections).
- 5. 15 ground water samples collected during each ground water sampling event.



60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 3D: Targeted Soil Mixing Using Earth Augers (2,375 CY) and Permanganate Injection Earth auger mixing (1/4 of FDDA), followed by permanganate injection (3/4 of FDDA).

	Estimated (Costs				
Item	Units	Quantity	Ŧ	Unit Cost		Estimated Total
Preparation			1			<u> </u>
Health and Safety Plan	LS	1	\$	5,000.00	\$	5,000
Mobilization/Demobilization	LS	1	\$	5,000.00	\$	5,000
Site Preparation and Tree Clearing	LS	1	\$	10,000.00	\$	10,000
Silt Fencing/Wetland Controls	LS	1	\$	5,000.00	\$	5,000
Road and Bridge Upgrade	LS	1	\$	10,000.00	\$	10,000
Earth Auger Mixing						
Mobilization	LS	1	\$	150,000.00	\$	150,000
Soil Mixing (quarter of area)	CY	2,375	\$	65.00	\$	154,375
Environmental Oversight	DAY	25	\$	1,000.00	\$	25,000
40 hour - OSHA for crew	LS	1	\$	2,500.00	\$	2,500
Permanganate (soil mixing)						
Potassium Permanganate	POUND	23,190	\$	2.00	\$	46,380
Water Supply Coordination	LS	1	\$	2,500.00	\$	2,500
Injection System			1			
Drilling and Injection Well Materials 4" Wells (2)	WELL	35	\$	750.00	\$	26,250
Drilling Oversight (2)	DAY	9	\$	1,000.00	\$	9,000
Permanganate Injection						
Delivery System (pumps, mixing tank)	LS	1	\$	3,000	\$	3,000
40% Sodium Permanganate	POUND	124,956	\$	2.50	 \$	312,390
Injection Events	EVENT	10	\$ \$	10,000.00	\$	100,000
Site Monitoring (once between injections)	VISIT	10	\$	1,000.00	\$	10,000
Ground Water Sample Analysis (4)	SAMPLE	100	\$	150.00	\$	15,000
Monitoring & Compliance Well Installation						
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$	1,250.00	\$	18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$	1,000.00	\$	5,000
Post-Treatment Ground Water Sampling (3 years)						
Ground Water Sampling (15 wells)	EVENT	12	\$	2,500.00	\$	30,000
Ground Water Sample Analysis (5)	SAMPLE	180	\$	150.00	\$	27,000
Site Restoration						
Site Clean Up and Demobilization	LS	1	\$	5,000.00	\$	5,000
				Subtotal:	\$	976,395
				ingineering:	\$	50,000
				ency (10%):	\$	102,640
		•	Total	(Rounded):	\$	1,129,000

- 1. 5X Permanganate Safety Factor for half of the impacted area (18,552 pounds \times 0.25 \times 5 = 23,190 pounds).
- 2. Assumes 4 wells installed per day.
- 3. 4X Permanganate Safety Factor for half of the impacted area (41,652 pounds x 0.75 x 4 = 124,956 pounds).
- 4. 10 ground water samples collected during each monitoring event (between injections).
- 5. 15 ground water samples collected during each ground water sampling event.

60 OLYMPIA AVENUE WOBURN, MASSACHUSETTS

ALTERNATIVE 4A: Enhanced In-Situ Biodegradation

Electron donor and culture injection.

	Estimated Co	sts			
ltem	Units	Quantity		Unit Cost	Estimated Total
Preparation					
Health and Safety Plan	LS	1	\$	5,000.00	\$ 5,000
Mobilization/Demobilization	LS	1	\$	5,000.00	\$ 5,000
Site Preparation and Tree Clearing	LS	1	\$	10,000.00	\$ 10,000
Silt Fencing/Wetlands Protection	LS	1	\$	5,000.00	\$ 5,000
Sheet Pile					
Sheet Pile & Sealing - 600 LF X 20FT BGS	LUMP	1	\$	110,000.00	\$ 110,000
Sheet Pile Installation Oversight	DAY	6	\$	500.00	\$ 3,000
Injection System			1		
Drilling and Injection Well Materials 2" Wells	WELL	45	\$	700.00	\$ 31,500
Drilling Oversight (1)	DAY	12	\$	1,000.00	\$ 12,000
Electron Donor and Culture Injection					
Injection System	DAY	30	\$	1,000	\$ 30,000
Sodium Lactate (2)	POUND	160,000	\$	1.00	\$ 160,000
Bacterial Culture (3)	LITER	1,200	\$	400.00	\$ 480,000
Injection Events	EVENT	30	\$	5,000.00	\$ 150,000
Site Monitoring	VISIT	60	\$	1,000.00	\$ 60,000
Monitoring & Compliance Well Installation			1		
Monitoring Wells - 1" PVC, clusters (3 wells each)	CLUSTER	15	\$	1,250.00	\$ 18,000
Monitoring Wells 12 1" PVC (Oversight)	DAY	5	\$	1,000.00	\$ 5,000
Post-Treatment Ground Water Sampling (3 years)					
Ground Water Sampling (15 wells)	EVENT	12	\$	2,500.00	\$ 30,000
Ground Water Sample Analysis (4)	SAMPLE	180	\$	150.00	\$ 27,000
Site Restoration					
Site Clean Up and Demobilization	LS	1	\$	5,000.00	\$ 5,000
				Subtotal:	\$ 1,146,500
			E	ngineering:	\$ 50,000
		Coi	nting	ency (10%):	\$ 119,650
		7	Total	(Rounded):	\$ 1,316,000

- 1. Assumes 4 wells installed per day.
- 2. Assumed 40,000 pounds of sodium lactate to reach target concentration of 200 mg/L (with 4X safety factor)
- 3. Two liters of bacterial culture injected in each injection well.
- 4. 15 ground water samples collected per sampling event.



January 10, 2003

Mr. Kevin Trainer GeoInsight Inc. 319 Littleton Road, Suite 105 Westford, MA 01886

Dear Kevin:

It was great talking to you today. As promised here is a capability profile I have put together to give you an idea of how we can help you remediate VOC contaminated soil.

The levels of contamination of TCE between 10-110ppm should be easily remediated using our Retek process. I would be pleased to do bench scale testing if you can provide me with representative samples. United Retek would not charge you for this service, and only charge for the actual laboratory analysis.

Based on the information you have provided I anticipate that the cost to process the material you have described at around \$40-\$60 per ton. Therefore we could process 11,000 cubic yards, assuming a density of 1.5 or 16,500 tons would be in the range of \$660,000 to \$990,000. This does not include mobilization, excavation and earth moving, or any additional expense involved in negative air scrubbing systems.

You should also take into account the fact that our on-site recycling and reuse of the material mitigates the costs needed to a) transport and dispose of the material, and b) transport backfill to the site. Providing your project with additional savings.

Kevin: Many thanks for your interest in United Retek and our Retek process. I would love the opportunity to work with you on this project and please do not hesitate to call me if you have any questions on the enclosed document.

lan Hadfield

Sihcerely

VP Business Development



Friday, January 17, 2003

Kevin Trainor Geo Insight 319 Littleton Road, Suite 204 Westford, MA 01886

RE:

60 Olympia Road Woburn, MA

Dear Mr. Trainor:

Thank you for taking the time to meet me on Wednesday January 15, 2003 to review the project at the rear of 60 Olympia Street, Woburn, Massachusetts. I have tried to break this proposal down into different phases so it would be easier to present to your client.

Scope of Work & Pricing

This project will be broken down into phases. Cyn Environmental Services will follow the phases listed below.

I. Mobilization

This includes mobilization of a frontend loader, PC300 excavator, two frac tanks, trailer mounted carbon system, four trailers of processed gravel, 200 feet of hay bales and silt fence, 25 rolls of 6 mil poly sheeting, two 20 foot long x 18 inch slotted pipe, and tow days of labor to set up equipment systems, stockpile areas, and road repair.

\$14,575.00

II. Demobilization

This includes the decon/demobilization of the above referenced equipment, the cleaning of two frac tanks, and the offsite disposal of 800 gallons of TCE contaminated water.

\$14,225.00

III. Shoring

This assumes excavation no deeper than 15 feet, four corners, and whalers along the top section of four walls.

\$275.00/linear foot

IV. Excavation and Stockpiling of Soil

This includes a four man crew, utility truck, PC 300 excavator, front end loader, two 3" submersible pumps and tow behind generator.

\$26.50/eubic yard

V. Backfilling

This includes a four man crew, utility truck, PC 300 excavator, front end loader, two 3" submersible pumps, tow behind generator, and a 900 lb roller.

\$17.00/cubic vard

VI. Backfill - General Fill

\$11.00/ton

VIII. Loading of Soil

Includes operator and PC 300 excavator or front end loader. Estimate loading 12-15 trailers per day.

\$1,350.00/day

IX. Dewatering

Includes operator, utility truck, two frac tanks, trailer with two 1000 lb. carbon units, one 1,000 lb sand filter, and two bag filters units, generator, and two submersible pumps.

\$1,350.00/day

X. Carbon Change Out

Change out includes 4,000 lbs of regenerated carbon and 1,000 lbs of sand. Disposal will be put into the stockpile.

\$4,900.00

XI. Transportation and Disposal of Soil

Less than 1,000 ppm TCE \$225.00/ton
Greater than 1,000 ppm TCE \$250.00/ton

We look forward to a favorable reply to this proposal and the opportunity to work with you. Do not hesitate to contact me if you have any questions at (800) 622-6365 extension 112.

Regards,

Steven Tucci Sales Manager

Date: January 13, 2002
To: Kevin Trainer, GEOInsight, Inc., 319 Littleton Road, Suite 105, Westford, MA 01886
From: Tom Girard, ENPRO Services, Inc.

Re: WELLS G&H, WOBURN, MA - BUDGET SOIL REMEDIATION PROJECT

DESCRIPTION OF TASK	NUMBER OF UNITS	UNIT OF MEASURE	\$ PER UNIT	TOTAL \$\$\$	Est. # of days per task
Mobilization, Site Set-up and Demobilization of Resources	1	EVENT	\$4,500.00	\$4,500.00	2
Sheetpile Installation	100	LN. FT.	\$395.00	\$39,500.00	2
Dewatering and Groundwater Treatment Granular Activated Carbon (GAC) Initial Charge	15 4000	DAY POUND	\$725.00 \$1.57	\$10,875 00 \$6,280.00	15
Solvent Contaminated Soil Removal and Stockpiling	2800	TON	\$7.25	\$20,300.00	6
Purchase and placement of Clean Imported Backfill (Granular Fill Materials)	2800	TON	\$15.75	\$44,100.00	6
Sheetpile Removal	100	LN. FT.	\$138.00	\$13,800.00	1
Loading of Solvent Contaminated Soil	2800	TON	\$3.00	\$8,400.00	8
Transportation and Disposal of Solvent Impacted Soil* "Assumes material has total TCE <60 PPM and can be directly landfilled without treatment."	2800	TON	\$185.00	\$518,000.00	
Massachusetts Hazardous Waste Transporters Fee	2800	TON	\$36.40	If Applicable	
Michigan Hazardous Waste Transporters Fee	2800	TON	\$10.00	Il Applicable	
General Site Clean-up and Demobilization of Resources	1	EVENT	\$4,500.00	\$4,500.00	2

SEA & SHORE CONTRACTING, INC. GENERAL, MARINE & EARTH-SUPPORT CONTRACTORS

12 Densmore Street - Quincy, MA 02171 Phone: 617-773-0001 - Fax: 617-773-0003

Fax Transmittal

Date:

February 3, 2003

No. of Pages Including this Transmittel Sheet: 2

To:

Kevin Trainer

Company:

Geo-Insight, Inc.

Fax No:

978-692-1115

Subject:

Cost Proposal for Sheet Pile Installation

Wells G&H Superfund Site

Woburn, MA

From:

Mike Lafty

Kevin.

The following page provides our proposal for installation of steel sheeting around the remediation area. We have researched other meterial types of sheet piling, but have concluded black carbon steel will be the most cost effective option, especially if the potassium permanganate is injected as a neutral solution. We note that it does not appear to be compatible with galvanized steel, and some types of PVC. The aluminized sheet piling as manufactured by Contech will be very expensive and does not appear to be any more compatible that carbon steel. Our suggestion is to use a slightly thicker sheet than would otherwise be required due to the driving conditions (soil density). In this way, the thicker steel would be sacrificial and the integrity of the sheeting barrier should remain. The other consideration is that ground conditions may vary around the perimeter of the site and the soils may get much stiffer/tougher to drive sheets into. Steel sheet piling is certainly the toughest piling product for this consideration.

The following costs should be considered a budget number, and we can potentially decrease these costs after visiting the site and discussing the requirements of the work. We can also search for used steel sheeting as the project gets closer to construction.

Please call if you have any questions regarding this information.

Thanks, Mike

Cell: 617-438-0694

SEA & SHORE CONTRACTING, INC. GENERAL, MARINE & EARTH-SUPPORT CONTRACTORS

12 Densmore Street - Quincy, MA 02171 Phone: 617-773-0001 - Fax: 617-773-0003

February 3, 2003

Geoinsight Inc. 319 Littleton Road, Suite 105 Westford, MA 01886

Attention:

Kevin Trainer

Subject:

Preliminary Proposal for Installation of Permanent Sheet Piling

Wells G&H Superfund Site Woburn, Massachusetts

Dear Kevin:

See & Shore Contracting is pleased to provide this preliminary proposal for the installation of permanent steel sheet piling to serve as a remediation treatment perimeter barrier. The perimeter of the barrier is estimated to be 800 linear feet, or a 120 ft by 280 ft box. The depth of sheet piling will be 15 ft below existing grades. The sheet piling will not be required to resist any significant lateral or vertical loading, and will be used as a barrier only.

We propose to install cold rolled CS69 sheet piling or equivalent to create the barrier. The wall thickness of this sheet piling is 0.25 in. We will install the sheet piling using a relatively small vibratory hammer and a 50-ton rough terrain crane.

Our preliminary bid price to install the 800 lf of sheet piling is \$115,500.

Our bid price is based on the following assumptions and conditions:

- All excavation (and any required dewatering) will be performed by others.
- Geolnsight will provide clear crane access to and around the work site to install and remove sheeting. We intend to mobilize up to a 50-ton rough terrain crane for this work. We assume that stable support for the crane is available (without the need of crane mats or other ground improvement) at the work site. All additional site work to prepare a stable bearing surface will be the responsibility of Aggregate Industries. We also assume that all underground and overhead utilities are relocated to a safe distance prior to our work and that no underground obstructions exist along the limits of the required sheet piling. Removal of underground obstructions (boulders, utilities, etc) and overhead restrictions (electrical wires, overhead utilities, trees, etc), if present, are the responsibility of Geolnsight or others. See & Shore Contracting will be compensated by Geolnsight or others in the amount of \$400/hr for each hour of stand-by time during removal of obstructions, relocation of underground utilities, or other stoppage of our work beyond the control of See & Shore.
- Sea & Shore will not be responsible for any damage to existing or new structures/buildings or underground fuel tanks/piping due to vibration or vibration-related settlement during pile driving or extraction activities. In our opinion and based on our assumptions of the subsurface conditions, we have selected a vibratory harmon of suitable size and energy to complete the excavation support installation without creating excessive vibration. However, some settlement of the existing granular soils should be expected due to pile driving vibrations.
- We have not included costs for any survey monitoring or vibration monitoring.

Geolasight Inc. February 3, 2003 Page 2

- We have included prevailing wage rates for our labor, but have not included Massachusetts sales tax.
- Geological or others will be responsible for determining the limits and alignment of the sheeting and clearly indicating/marking the limits in the field.

Thank you for the invitation to submit this preliminary price quote and we look forward to working with you on this project. Please call me at 617-438-0694 if you have any questions regarding this quote or if we be of any further assistance at this time.

Very Truly Yours

Sea & Shore Contracting, Inc.

Michael J. Lally

Senior Project Manager



January 22, 2004

Ms. Christene A. Binger Geo Insight, Inc. 319 Littleton Road, Suite 105 Westford, MA 01886

RF:

Olympia Property, Woburn, MA

Soil Mixing Proposal

Dear Ms. Binger:

Raito, Inc. is pleased to provide the following proposal to provide a shallow cement bentonite cutoff wall, and soil mixing services to incorporate potassium permanganate into the soil contained within the cutoff wall area.

The quantities involved are the following:

- Cutoff Wall -9,600 sq. ft. (480 lf x 20 feet deep)
- Soil Remediation Mixing 9,500 cu. yds.

Raito, Inc. will use a triple axle mixing system which represents the state of the art equipment available today for the soil mixing contracting industry. The Raito, Inc. soil mixing system comes with a computer controlled mixing and pumping plant to provide and meter to the soil mixing drill rig accurate volumes of stabilization or reagent materials as required by the project specifications. The drill rig is also fully computer controlled to monitor the injection and drilling process. We provide daily quality control reports for each column injection. We believe our quality control monitoring and reporting process is the best system available on the American market today.

Our price to complete the above captioned work is as follows:

Mobilization (Lump Sum)

\$150,000.00

Cutoff Wall (9,600 sf)

\$12.50/sf (\$120,000.00)

Soil Remediation Mixing (9,500 cy)

\$65.00/cy (\$617,500.00)

Our price includes providing all equipment, manpower and materials including the cement and bentonite materials necessary to complete the cutoff wall. It is our understanding that the cutoff wall is primarily intended to isolate the remediation area from the local ground water table such that the soil

594 Marrett Road, Suite 9 * Lexington, MA 02421 * Phone: (781) 863-6270 * Fax: (781) 274-0569

2147 Priest Bridge Drive, Suite 15 * Crofton, MD 21114 * Phone: (410) 451-9700 * Fax: (410) 451-4400

1660 Factor Avenue * San Leandro, CA 94577 * Phone: (510) 346-9840 * Fax: (510) 346-9841

remediation work with potassium permanganate can be installed, and the reagent can be kept in place to interact with the in-situ contamination. In that context, it is our understanding that the cutoff wall is not intended to be a long-term remediation measure for this site.

With respect to the soil remediation, Geo Insight will provide the dry potassium permanganate reagent material for the soil remediation mixing. Raito, Inc. will mix the potassium permanganate with a sufficient quantity of water (approximately 6 to 8 gallons of water per one pound of reagent material) to produce an adequate volume of reagent slurry to mix into the soil profile.

Raito, Inc. will complete the cutoff wall installation first. Upon completion of the cutoff wall installation, Raito will complete a test section of involving an area of approximately 10 feet by 20 feet. Raito, Inc. will complete the test section using standard soil mixing procedures (one cycle). Upon completion of the test section, Raito, Inc. has included a one week standby period to allow Geo Insight to conduct tests on the test area. Should adjustments in the soil mixing procedure be required, Raito, Inc. will adjust its soil mixing procedures based on the test results. Should the testing program extend beyond one week, either due to testing requirements, or the need to do additional soil mixing test sections, such additional costs will be billed as extra work.

We understand that the reagent material will dissolve in the make-up water, and therefore we understand that the injection material will be a homogenous mixture. On this basis we believe the Raito, Inc. soil mixing process can achieve a reasonable level of dispersion of the reagent slurry in the site soil profile. However, while we will make our best effort to assure an even mixing of the material into the site soil profile, we are not able at this time to provide any specific guarantees on the performance of the potassium permanganate reagent mixture.

Should you have any questions, please do not hesitate to call.

Yours truly,

David C. Lager

DCL: aa

9784228619 ENVIRONMENTAL DICULLING

A GEOSEARCH COMPANY

Main Office: 11 Chocksett Road Sterling, MA 01564

PHONE (978) 422-8617 FAX (978) 422-8619

7	ATV Price Quot		· · · · · · · · · · · · · · · · · · ·	
Christine Binger		Drilling & Well I		
Geolasight, Inc		Location	Woburn.,MA	
319 Littleton Road/ Suite 204				
Westford, MA 01886		EDI Rep:	Jim Brodrick	
978-692-1114				
978-692-1115		12/8/2003	Geoinsight0329-atv(4" PVC)
SCOPE: Drill and install thirty (30) 4" PVC wells	to a depth of 15 ft ea	ch. NO soil samplir	ng needed. Roadway b	oxes
at the surface, set in l'x1' pads. No saw cuts need	ed. 10 ft of screen p	er well. Grout abo	ve the bentonite seal.,	
Prices based on installing 4" PVC wells	·			
		Prices	Amount	Cost
Drilling Truck Rig (per diem)	day	\$1,275.00	10	\$12,750.00
Mobilization/demobilization (Drill Rig)	lump sum	\$100.00	3	\$300.00
Daily Crew Travel/ Support Truck	per hour	\$65.00	30	\$1,950.00
Large Auger Rental	day	\$100.00	10	\$1,000.00
Overtime		\$295.00	0	\$0.00
Well Material:				
Screen (4" PVC)	per ft	\$15.00	600	\$9,000.00
Riser (4" PVC)	per ft	\$9.00	300	\$2,700.00
EndPlugs (4" PVC)	each	\$15.00	60	\$900.00
Sand	per bag	\$7.50	600	\$4,500.00
Bentonite	per bag	\$32.00	30	\$960.00
Concrete	per bag	\$12.00	60	\$720.00
Grouting	per ft	\$6.00	300	\$1,800.00
	•			•
urface Protection:				
Protective Casings	each	\$90.00	0	\$0 .00
Flush Mounted Roadway Box (7")	each	\$70.00	0	\$0.00
Flush Mounted Roadway Box (8")	each	\$75.00	60	\$4,500.00
Expansion Plugs	each	\$35.00	60	\$2,100.00
Rock Coring				
Bit Wear (Coring - NX)	per st	\$25.00	0	\$0.00
Bit Wear (Coring - HV conventional)	per ft	\$35.00	0	\$0.00
Bit Wear (Coring - HV wire-line)	per ft	\$38.00	0	\$0.00
Bit Wear (- 4")	per ft	\$20.00	0	\$0,00
Bit Wear (- 5")	per ft	\$25.00	0	\$0.00
Bit Wear (- 6")	per ft	\$30.00	0	\$0.00
3it Wear (- 9")	per ft	\$45.00	0	\$0.00
Compressor Rental (Large)	day	\$350.00	2	\$700.00
Core Box	each	\$30.00	0	\$0.00
Personnel Protection	Quoted per job.		0	
Additional Material				
OOT Drums	each	\$50.00	0	\$0.00
oly Sheeting	roll	\$80.00	0	\$0.00
Whale Pump	each	\$75.00	0	\$0.00
			Total	<u>\$43,880,00</u>

\$730/well

ENVIRONMENTAL DRILLING

A GEOSEARCH COMPANY

Main Office: 11 Chocksett Road Sterling, MA 01564

PHONE (978) 422-8617

FROM-ENVIROMENTAL DRILLING

FAX (978) 422-8619

Christine Binger		Drilling & Well		
GeoInsight, Inc		Location	Woburn.,MA	
319 Littleton Road/ Suite 204				
Westford, MA 01886		EDI Rep:	Jim Brodrick	
978-692-1114				
978-692-1115		12/8/2003	Geoinsight0329-atv(
SCOPE: Drill and install thirty (30) 4" PVC well				oxes
at the surface, set in l'x1' pads. No saw cuts nee	ded. 10 ft of screen p	oer well. Grout abo	ove the bentonite seal.,	
Prices based on installing 4" PVC wells				
		Prices	Amount	Cost
Drilling Truck Rig (per diem)	day	\$1,275.00	5	\$6,375.00
Mobilization/demobilization (Drill Rig)	iump sum	\$100.00	3	\$300.00
Daily Crew Travel/ Support Truck	per hour	\$65.00	15	\$975.00
Large Auger Rental	day	\$100.00	5	\$500.00
Overtime		\$295.00	0	\$0,00
Wall Mutarial				
Well Material:	£	@1 <i>E</i> 00	300	\$4,500.00
Screen (4" PVC) Riser (4" PVC)	per ft	\$15.00 \$0.00	300 150	\$4,500.00 \$1,350.00
EndPlugs (4" PVC)	per ft each	\$9.00 \$15.00	30	\$1,350.00 \$450.00
· · · · · · · · · · · · · · · · · · ·				\$2,250.00
Sand Bentonite	per bag	\$7.50 \$32.00	300 15	\$2,230.00 \$480.00
	per bag		30	\$360.00
Soncrete	per bag	\$12.00 \$6.00	150	\$900.00
outing	per ft	20.00	120	3700.00
Surface Protection:				
Protective Casings	each	\$90.00	0	\$0.00
Flush Mounted Roadway Box (7")	each	\$70.00	٥	\$0.00
Flush Mounted Roadway Box (8")	each	\$75.00	30	\$2,250.00
Expansion Plugs	each	\$35.00	30	\$1,050.00
•				
Rock Coring				
Sit Wear (Coring - NX)	per fi	\$25.00	0	\$0 .00
Bit Wear (Coring - HV conventional)	per ft	\$35.00	0	\$0.00
Bit Wear (Coring - HV wire-line)	per ft	\$38.00	0	\$0.00
Bit Wear (- 4")	per ft	\$20.00	0	\$0.00
Bit Wear (- 5")	per ft	\$25.00	0	\$0.00
3it Wear (- 6")	per ft	\$30.00	0	\$0.00
Bit Wear (- 9")	per ft	\$45.00	0	\$0.00
Compressor Rental (Large)	day	\$350.00	1	\$350.00
Соте Вох	each	\$30.00	0	\$0.00
Personnel Protection	Quoted per job.			
Additional Material				
OOT Drums	each	\$50.00	?	\$0.00
oly Sheeting	roll	\$80.00	0	\$0.00
Vhale Pump	each	\$7 5, 0 0	0	\$0.00
_			<u>Total</u>	\$22,090,00

ENVIRONMENTAL DRILLING

A GEOSEARCH COMPANY

Main Office: 11 Chocksett Road

Sterling, MA 01564

FAX (978) 422-8619

PHONE (978) 422-8617 ATV Price Quote Drilling & Well Installation Christine Binger Geolasight, Inc. Location Woburn., MA 319 Littleton Road/ Suite 204 Westford, MA 01886 EDI Reo: Jim Brodrick 978-692-1114 12/8/2003 978-692-1115 Geoinsight0329-atv(4" PVC) SCOPE: Drill and install thirty (30) 4" PVC wells to a depth of 15 ft each. NO soil sampling needed. Roadway boxes at the surface, set in 1'x1' pads. No saw cuts needed. 10 ft of screen per well. Grout above the bentonite seal., Prices based on installing 4" PVC wells Prices Amount Cost 15 Drilling Truck Rig (per diem) \$1,275.00 \$19,125.00 dav Mobilization/demobilization (Drill Rig) 3 \$300.00 \$100.00 muz qmul 45 Daily Crew Travel/ Support Truck per hour \$65.00 \$2,925.00 Large Auger Rental 15 \$1.500.00 day \$100.00 Overtime \$200,00 0 \$0.00 Well Material: Screen (4" PVC) 900 \$13,500.00 per ft \$15.00 Riser (4" PVC) per ft \$9.00 450 \$4,050.00 EndPlugs (4" PVC) \$1,350.00 90 each S15.00 900 \$6,750.00 Sand per bag \$7.50 Bentonite \$1,440.00 \$32.00 45 per bag Concrete 90 \$1,080.00 \$12.00 per bag outing \$6.00 450 \$2,700.00 per ft Surface Protection: 20 00 Protective Casings \$90.00 0 each Flush Mounted Roadway Box (7") each \$70.00 n \$0.00 Flush Mounted Roadway Box (8") \$75.00 90 \$6,750.00 each 90 Expansion Plugs \$35.00 \$3,150.00 each Rock Coring Bit Wear (Coring - NX) per ft \$25.00 0 \$0.00 Bit Wear (Coring - HV conventional) \$35,00 0 00.02 per ft Bit Wear (Coring - HV wire-line) \$38.00 ß 00.02 per ft Bit Wear (- 4") ٥ \$0.00 \$20.00 per ft Bit Wear (- 5") \$25.00 0 \$0.00 per ft Bit Wear (- 6") O \$0.00 per ft \$30.00 Bit Wear (- 9") \$45.00 0 \$0.00 per ft Compressor Rental (Large) 3 \$1.050.00 \$350.00 day Core Box \$0.00 \$30.00 0 each Personnel Protection Quoted per job. 0 Additional Material DOT Drums 0 \$0.00 \$50.00 each Poly Sheeting \$80.00 00.02 roll 0 Whale Pump \$75.00 0 \$0,00 each

\$ Tag/well

\$65,670.00

Total

SEA & SHORE CONTRACTING, INC.

GENERAL, MARINE & EARTH-SUPPORT CONTRACTORS

33 Union Street, LL1 - Boston, MA 02108 Phone: 617-523-1692 - Fax: 617-523-1694

December 23, 2003

Geolnsight, Inc. 319 Littleton Road, Suite 105 Westford, MA 01886

Attention:

Christine Binger

Subject:

Revised Price Proposal for Installation of Permanent Sheet Piling

Wells G&H Superfund Site

Woburn, MA

Dear Christine.

Sea & Shore Contracting is pleased to provide this revised price proposal for labor, materials and equipment to install up to 600 lf of permanent steel sheet piling to enclose a rectangular area of approximately 120 ft by 180 ft at the site identified above. We understand that corner sheets will be required to provide a full perimeter sheeted cofferdam. To decrease the seepage between the cold-rolled sheet piling interlocks, we will furnish and apply a specialty sealant material within the female interlock prior to installation. Details of the sealant material will follow under separate cover. We understand the intention of the sheet piling is to create a low permeability barrier to confine chemical reagents that will be injected into the soil, within the cofferdam, as a treatment system. The sheeting will only need to support limited and local excavation depths loss than approximately 5 ft below the top of the sheeting.

Scope of Work:

We propose to perform the following scope of work for this project.

- 1. Mobilize a 50 ton crane and H&M Vibro 150 vibratory hammer for sheet piling installation
- 2. Furnish and install up to 600 lf of 20 ft long, cold-rolled sheet piling with a minimum section modulus of 8 in³/lf (Skyline CS69 or equivalent sheet piling).
- 3. Furnish and apply interlock sealant material during sheet piling installation.
- 4. Demobilize crane and pile driving equipment.

We note that we have not yet visited the site but assume clear crane and truck access is available to the work site and that no overhead or underground utilities lie within the limits of work. We also assume that there are no existing buildings or other significant structures within 15 ft of the excavation area that would result in restrictions to our work area or would be judged "vibration sensitive."

We estimate that a total of approximately 10 working days will be required to install the steel sheeting.

Our bid price to provide labor, materials and equipment to perform the scope of work described herein is \$109,700.

Geolnsight, Inc. December 23, 2003 Page 2

Our bid prices are based on the following assumptions and conditions:

- 1. All sitework including any excavation, trenching, filling and dewatering will be performed by others at no cost to Sea & Shore.
- 2: GeoInsight will provide clear access to and around the work site to install the sheeting. We intend to mobilize up to a 50-ton rough terrain crane or crawler crane for this work. We assume that stable support for the crane is available (without the need of crane mats or other ground improvement) at the work site. All additional site work to prepare a stable bearing surface will be the responsibility of GeoInsight. We also assume that all underground and overhead utilities are relocated to a safe distance prior to our work and that no underground obstructions exist along the limits of the required sheet piling. Removal of underground obstructions (boulders, utilities, etc.) and overhead restrictions (electrical wires, overhead utilities, trees, etc.), if present, are the responsibility of GeoInsight. Sea & Shore Contracting will be compensated by GeoInsight in the amount of \$400/hr for each hour of stand-by time during removal obstructions, relocation of underground utilities, or other stoppage of our work beyond the control of Sea & Shore.
- 3. Sea & Shore will not be responsible for any damage to existing or new structures/buildings or underground fuel tanks/piping due to vibration or vibration-related settlement duting pile driving activities. In our opinion and based on our assumptions of the subsurface conditions, we have selected a vibratory hammer of suitable size and energy to complete the sheet piling installation without creating excessive vibration. However, some settlement of the existing granular soils should be expected due to pile driving vibrations.
- 4. We have not included costs for any survey monitoring or vibration monitoring.
- 5. We have not included State or Federal prevailing wage rates or union crews for our labor. Sea & Shore contracting is a non-union company.
- 6. We have not included State sales tax in our pricing.
- 7. The pricing herein is subject to sheet piling availability and mill pricing at the time of ordering. Our pricing has included sheet piling costs of up to \$0.32/lb, which is the current mill pricing. If sheet piling costs at the mill are higher at the time of award of this contract to Sea & Shore, we reserve the right to an equitable increase in this contract amount.
- 8. GeoInsight will be responsible for determining the limits and alignment of the sheeting and clearly indicating/marking the limits in the field.

This proposal is valid for 30 days following the date of this proposal.

Thank you for the invitation to submit this price quote and we look forward to working with you on this project. Please call me at 617-438-0694 if you have any questions regarding this quote.

Very Truly Yours

Sea & Shore Contracting, Inc.

Michael J Lally

Senior Project Manager

APPENDIX J
Laboratory NELAC Certifications: Groundwater Analytical Inc.

GROUNDWATER ANALYTICAL

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Groundwater Analytical is a NELAC accredited laboratory. We maintain environmental laboratory certification or accreditation in the following states:



- Connecticut
- Florida
- Maine
- Massachusetts
- New Hampshire
- New York
- · Rhode Island
- Vermont

Other laboratory documentation:

- Pennsylvania Registration
- USDA Soil Permit
- MA DEP EPH-VPH Proficiency Record

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Related NELAC Links

Restructuring NELAC

The National Environmental Laboratory Accreditation Conference (NELAC) is a voluntary association of State and Federal agencies with full opportunity for input from the private sector. NELAC's purpose is to establish and promote mutually acceptable performance standards for the operation of environmental laboratories. EPA's National Environmental Laboratory Accreditation Program (NELAP) office provides support to NELAC and evaluation of the accrediting authority programs.

The NELAC Home Page contains documents and files on the NELAC Constitution and Bylaws, all the current standards, as well as all proposed changes to these documents. Also included are a history of the Conference, minutes of recent meetings, announcements of upcoming conferences and meetings, related information, the NELAC directory, and an open forum for discussion of NELAC issues.

NELAC Files and Documents					
NELAC Constitution and Bylaws	NELAC Directory PDF(40K)				
About the Standards Submitting Comments 1999 NELAC Standards (Effective July 2001) 2000 NELAC Standards (Effective July 2002) 2001 NELAC Standards (Effective July 2003) 2002 NELAC Standards (Effective July 2004)	Board of Directors Standing Committees Administrative Committees Ad Hoc Committees Environmental Laboratory Advisory Board (ELAB) Accrediting Authority Review Board (AARB)				
Proposed Standards	Archives				

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Last updated on Monday, June 30th, 2003 URL: http://www.epa.gov/ttn/nelac/



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Groundwater Analytical has established and maintains a corporate Quality Assurant Plan (QAP). The corporate Quality Assurance Plan establishes an integrated plan o quality control procedures and laboratory operational policies to assure that the data generated by the laboratory is of known and accepted quality.

All employees of Groundwater Analytical are responsible for knowing the contents of the corporate Quality Assurance Plan. Each employee is obligated to carry out his of her daily tasks in accordance with the operational policies outlined in the Quality Assurance Plan, and the written Standard Operating Procedures of the laboratory.

Sample Receipt and Custody

Upon receipt by Groundwater Analytical, all samples proceed through an orderly processing sequence specifically designed to ensure continuous integrity of both the sample and its documentation.

All samples are received and inspected by the Sample Management section of Groundwater Analytical's Client Services Department. All samples received by the laboratory require an appropriate Chain of Custody form and work order. Each sample is carefully checked for damage, correct label identification, complete work order documentation, and compliance with regulatory container, preservation and holding time requirements.

Preparation Batch Quality Control

All samples are processed in batches of samples of the same matrix requiring the same method of analysis. A sample preparation batch consists of 20 or fewer samples that are processed.

For most organic analyses, each sample in a sample preparation batch is spiked will a surrogate compound(s), as specified by the applicable methodology.

For each sample preparation batch processed, the laboratory also analyzes several quality control samples. Typically, the laboratory analyzes a blank, a laboratory control sample, a matrix spike sample, and a sample duplicate with each sample preparation batch. Specific analytical methods may have additional preparation batc quality control requirements.

• Preparation Blanks

Preparation Blanks consist of reagents specific to the method being employed that are carried through every aspect of the procedure, including preparation, clean-up, and analysis. Preparation blanks are analyzed to assess the level of background interference or contamination that exists in the analytical system which might lead to the reporting of elevated concentration levels or false positive data.

• Laboratory Control Samples

Laboratory Control Samples are aliquots of reagent water or sodium sulfate spiked with a group of target compounds representative of the method analytes, and carried through every aspect of the procedure, including preparation, clean-up, and analysis. Laboratory control samples are analyze to monitor the accuracy of the analytical procedure, independent of matrix effects. Control limits for accuracy for each analyte are based on the criteria

established in the applicable methodology, or the historical data of the laboratory

Matrix Spike Samples

Matrix Spike Samples are aliquots of client-supplied environmental samples that are spiked with target compounds representative of the method analyte and carried through every aspect of the procedure, including preparation, clean-up, and analysis. Matrix spike samples are analyzed to evaluate the effect of the sample matrix on the accuracy of the analytical procedure.

Sample Duplicates

Sample Duplicates are second aliquots of client-supplied environmental samples that are carried through every aspect of the procedure, including preparation, clean-up, and analysis. Duplicate samples are analyzed to evaluate the precision of the analytical procedure. The relative percent difference (RPD) between the two determinations is calculated and compared to defined laboratory acceptance criteria.

Surrogate Compounds

Surrogate Compounds are organic compounds which are similar to the analytes of interest in chemical behavior, but which are not normally found i environmental samples. Surrogates are added to samples to monitor the effect of the specific sample matrix on the accuracy of the analysis.

Instrument Calibration Procedures

Prior to the analysis of samples, standard calibration curves of signal response versus analyte concentration are generated on each analytical instrument that will be used for a project. Standard calibration curves are generated by the analysis of a series of standard solutions over a concentration range appropriate for the samples to be analyzed. The number and concentration of calibration standards required is specific to the analytical methodology employed.

• Gas Chromatograph/Mass Spectrometry (GC/MS)

GC/MS methodologies require that the GC/MS be tuned each day prior to analysis of samples. The tuning compound used for volatile organic analyse is 4-Bromofluorobenzene (BFB). The tuning compound used for semivolatile organic analyses is Decafluorotriphenylphosphine (DFTPP). No samples ar analyzed until the GC/MS has met the tuning criteria as specified by the applicable method. Once tuning criteria are met, the GC/MS is then calibrated for all target compounds. Typically, a five point calibration curve i used, depending on the specific methodology. On a daily basis, continuing calibration is verified by using a continuing calibration verification standard, which is usually prepared at the midpoint of the multi-point calibration curve Typically, various System Performance Check Compounds (SPCCs) are checked for a minimum average relative response factor (RRF), and variou Continuing Calibration Compounds (CCCs) are checked for a maximum relative percent difference between the RRF of the multi-point calibration ar the calibration verification. Performance criteria for calibration, as defined in the specific methodology, must be met prior to the analysis of samples. Continuing calibration standards are prepared from a source independent o the multi-point calibration standard. Upon meeting all performance criteria, typically samples must be analyzed within a 12 hour period, after which the system performance characteristics must be verified by re-tuning and checking continuing calibration.

Gas Chromatography (GC)

GCs are calibrated for all target compounds prior to the analysis of samples Typically, a five point calibration curve is used, depending on the specific methodology. The multi-point calibration curve is used to determine the instrument's linear range, average response factors, average retention time windows and average peak heights or average peak area for all target compounds being analyzed. On a daily basis, continuing calibration is verified by using a calibration verification standard, which is usually prepare at the midpoint of the multi-point calibration curve. Continuing calibration standards are prepared from a source independent of the multi-point calibration standard. Performance criteria for calibration, as defined in the specific methodology, must be met prior to the analysis of samples. Typical' a continuing calibration verification standard, which is usually also a midpoint, is then analyzed at a frequency of once every ten samples analyzed. The instrumental sequence ends with the analysis of a continuing

calibration verification standard. Individual gas chromatography methods may also have additional method specific calibration verification requirements

Atomic Absorption Spectrophotometry (AA)

AAs are calibrated immediately prior to analysis typically using a blank and four standards. The calibration is then verified before, during and after sample analysis using blanks and calibration verification standards. Continuing calibration standards are analyzed after every ten samples. Continuing calibration standards are prepared from a source independent of the multi-point calibration standard. Post-digestion analytical spikes are performed on all client samples to monitor for matrix effects.

Inductively Coupled Plasma-Atomic Emission Spectrophotometry (ICF AES)

ICPs are calibrated at least monthly using a blank and two multi-element standards. The calibration is updated daily prior to analysis using a blank ar reslope standard which is the same as the high standard used for the monthly calibration. The calibration is verified before, during and after samp analysis using blanks and calibration verification standards. Continuing calibration standards are analyzed after every ten samples. Continuing calibration standards are prepared from a source independent of the multipoint calibration standard.

Data Reduction, Validation and Reporting

All analytical data generated are carefully checked for accuracy and completeness. The data validation process, or the process by which data are accepted or rejected, consists of data generation, reduction, and three levels of review, as described below.

The analyst who generates the analytical data has the primary responsibility for the correctness and completeness of the data. All data are generated and reduced following the protocols specified by laboratory SOPs. Each analyst then reviews the quality of his or her work based on an established set of guidelines. The review step performed by the analyst is designated the Initial Review.

Data is reviewed on the basis of a data package. Data packages are comprised of the raw and reduced data for a group of sample results for a specific methodology, and the raw and reduced data for all of the associated preparation batch quality control sample results and instrumental calibration results.

Upon completion of the initial review, each data package is reviewed by a Supervisc or Manager, whose function is to provide an independent review of the data packag. This review is also conducted according to an established set of guidelines. The review step performed by a Supervisor or Manager is designated the Technical Review.

Upon completion of the Technical Review, each data package is dissembled and individual sample results are assigned to the appropriate project folder for reporting. After all of the analytical requirements for a project are complete, a project report is prepared for release to the client.

Prior to release of a project report to the client, the Project Manager assigned to the project is responsible for reviewing the report to ensure that the data meet the overa objectives of the client, as understood by the Project Manager. The review step performed by the Project Manager is designated the Project Review.

Corrective Action Procedures

When non-conformances, deficiencies or errors occur, the Quality Assurance Plan provides several systematic procedures to address the discrepant situation. The two primary systematic procedures employed are a Non-Conformance Report and a Corrective Action Report.

Non-Conformance Report (NCR)

An NCR is used to document sample conditions or analytical conditions outside the recommended criteria of the laboratory. For example, at time of sample receipt, the Sample Management Department will use a Sample Receiving Non-Conformance Report to document variances from regulatory

container, preservation and holding time requirements, and to note all documentation errors or omissions. The laboratory operations staff will use an Analytical Non-Conformance Report to document all analytical elements outside established criteria. For example, unacceptable surrogate compoun recoveries, unacceptable laboratory control sample recoveries, and unacceptable calibration check sample results must all be documented by use of a Non-Conformance Report.

Corrective Action Report (CAR)

A CAR is used for all other discrepant situations, not specific to samples or analytical elements with specified criteria, that occur which require resolutio in order to maintain the proper functioning of the laboratory within the guidelines established by the Quality Assurance Plan. All Non-Conformance Reports and Corrective Action Reports are forwarded to, reviewed by, and acted upon by the appropriate Department Manager. A such reports are then filed with, and reviewed by, and followed up by the Quality Assurance Manager.

Performance and System Audits

Periodically, the Quality Assurance Officer conducts performance audits and system audits of the laboratory to ensure that personnel are adhering to the procedures set forth in the Quality Assurance Plan. These audits may entail observation of procedures as they are carried out, or a review of records to demonstrate traceabilit and compliance with all required documentation procedures. Reports of the findings of these audits are made to management.

Standard Operating Procedures

All analytical methodologies are conducted according to written Standard Operating Procedures (SOPs).

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The Commonwealth of Massachusetts



Department of Environmental Protection

Division of Environmental Analysis Senator William X. Wall Experiment Station

certifies

M-MA103

GROUNDWATER ANALYTICAL INC 228 MAIN ST

BUZZARDS BAY, MA 02532-0000

Laboratory Director: David L. Sanford

for the analysis of

NON POTABLE WATER (CHEMISTRY) POTABLE WATER (MICROBIOLOGY) **POTABLE WATER (CHEMISTRY)**pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P. Contact the Division of Environmental Analysis to verify the current certification status of the laboratory.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

01 JUL 2003

Expires:

Issued:

30 JUN 2004

Director, Division of Environmental Analysis

Vacar Q. Parrale

Certified Parameter List as of:

01 JUL 2003

M-MA103

GROUNDWATER ANALYTICAL INC

BUZZARDS BAY MA

NON POTABLE WATER (CHEMIS	STRY)	Effective Date	09 FEB 2003	Expiration Date	30 JUN 2004
Analytes a	nd Methods				
ALUMINUM	EPA 200.7		KJELDAHL-N		EPA 351.2
ANTIMONY	EPA 200.7		KJELDAHL-N		LACHAT 10-107-06-02-D
ARSENIC	EPA 200.7		ORTHOPHOSPHATE		SM 4500-P-F
BERYLLIUM	EPA 200.7		ORTHOPHOSPHATE		LACHAT 10-115-01-1-A
CADMIUM	EPA 200.7		TOTAL PHOSPHORUS		EPA 365.4
CHROMIUM	EPA 200.7		TOTAL PHOSPHORUS		LACHAT 10-115-01-1-C
COBALT	EPA 200.7		CHEMICAL OXYGEN DEMA	AND	SM 5220D
COPPER	EPA 200.7		BIOCHEMICAL OXYGEN D	EMAND	SM 5210B
COPPER	EPA 220.2		TOTAL CYANIDE		EPA 335.3
IRON	EPA 200.7		TOTAL CYANIDE		LACHAT 10-204-00-1-A
LEAD	EPA 200.7		NON-FILTERABLE RESIDU	JΕ	SM 2540D
MANGANESE	EPA 200.7		TOTAL RESIDUAL CHLORI	INE	SM 4500-CL-G
MERCURY	EPA 245.1		OIL AND GREASE		SM 5520B
MOLYBDENUM	EPA 200.7		TOTAL PHENOLICS		EPA 420.2
NICKEL	EPA 200.7		TOTAL PHENOLICS		LACHAT 10-210-00-1-B
SELENIUM	EPA 200.7		VOLATILE HALOCARBONS	3	EPA 601
SILVER	EPA 200.7		VOLATILE HALOCARBONS	5	EPA 624
STRONTIUM	EPA 200.7		VOLATILE AROMATICS		EPA 602
THALLIUM	EPA 200.7		VOLATILE AROMATICS		EPA 624
TITANIUM	EPA 200.7		CHLORDANE		EPA 608
VANADIUM	EPA 200.7		ALDRIN		EPA 608
ZINC	EPA 200.7		DIELDRIN		EPA 608
PH	SM 4500-H-B		DDD		EPA 608
SPECIFIC CONDUCTIVITY	SM 2510B		DDE		EPA 608
TOTAL DISSOLVED SOLIDS	SM 2540C		DDT		EPA 608
TOTAL HARDNESS (CACO3)	SM 2340B		HEPTACHLOR		EPA 608
TOTAL HARDNESS (CACO3)	EPA 200.7		HEPTACHLOR EPOXIDE		EPA 608
CALCIUM	EPA 200.7		POLYCHLORINATED BIPH	ENYLS (WATER	
MAGNESIUM	EPA 200.7		POLYCHLORINATED BIPH	ENYLS (OIL)	EPA 600/4-81-045
SODIUM	EPA 200.7				
POTASSIUM	EPA 200.7				
TOTAL ALKALINITY	EPA 310.2				
TOTAL ALKALINITY	LACHAT 10-303	J-31-1-A			
CHLORIDE	EPA 325.2				
CHLORIDE	EPA 300.0				
CHLORIDE	LACHAT 10-117	′-07-1-A			
SULFATE	EPA 300.0				
AMMONIA-N	SM18-B,H/19,20				
AMMONIA-N	LACHAT 10-107				
NITRATE-N	SM 4500-NO3-F	•			
NITRATE-N	EPA 300.0				
NITRATE-N	LACHAT 10-107	-04-1-C			

June 30, 2003

* Provisional Certification

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Certified Parameter List as of: 01 JUL 2003

M-MA103

GROUNDWATER ANALYTICAL INC

BUZZARDS BAY MA

POTABLE WATER (CHEMISTRY)	Effective Date	01 JUL 2002	Expiration 30 JUN 2004 Date
Analytes a	nd Methods		
ANTIMONY	EPA 200.9		
ARSENIC	EPA 200.7		
ARSENIC	EPA 200.9		
BARIUM	EPA 200.7		
BERYLLIUM	EPA 200.7		
CADMIUM	EPA 200.7		
CHROMIUM	EPA 200.7		
COPPER	EPA 200.7		
LEAD	EPA 200.9		
MERCURY	EPA 245.1		
NICKEL	EPA 200.7		
SELENIUM	EPA 200.9		
THALLIUM	EPA 200.9		
NITRATE-N	SM 4500-NO3-F		
NITRATE-N	LACHAT 10-107-04-1-C		
NITRITE-N	EPA 300.0		
NITRITE-N	SM 4500-NO3-F		
FLUORIDE	EPA 300.0		
FLUORIDE	SM 4500-F-C		
SODIUM	EPA 200.7		
SULFATE	SM 4500-SO4-F		
CYANIDE	EPA 335.4		
CYANIDE	LACHAT 10-204-00-1-A		
RESIDUAL FREE CHLORINE	SM 4500-CL-G		
CALCIUM	EPA 200.7		
TOTAL ALKALINITY	SM 2320B		
TOTAL DISSOLVED SOLIDS	SM 2540C		
PH	SM 4500-H-B		
TRIHALOMETHANES	EPA 524.2		
VOLATILE ORGANIC COMPOUNDS	EPA 524.2		
1,2-DIBROMOETHANE	EPA 504.1		
1,2-DIBROMO-3-CHLOROPROPANE	EPA 504.1		

Date

Certified Parameter List as of:

M-MA103 GROUNDWATER ANALYTICAL INC

BUZZARDS BAY MA

POTABLE WATER (MICROBIOLOGY)

Effective 05 JUL 2002

01 JUL 2003

Expiration 30 JUN 2004

Date

Analytes and Methods

TOTAL COLIFORM

MF-SM9222B

TOTAL COLIFORM

ENZ. SUB. SM9223

FECAL COLIFORM

MF-SM9222D

HETEROTROPHIC PLATE COUNT

SM9215B

E. COLI

EC-MUG-SM9221F

E. COLI

ENZ. SUB. SM9223

E. COLI

NA-MUG-SM9222G

Certified Parameter List as of: 09 FEB 2003

M-CT020

EAS LABORATORIES INC

WATERTOWN CT

NON POTABLE WATER (CHEM		Effective Date	09 FEB 2003	Expiration Date	30 JUN 2003
<u>Analytes</u>	and Methods				
ALUMINUM	EPA 200.7		HEPTACHLOR		EPA 608
ANTIMONY	EPA 200.7		HEPTACHLOR EPOXIDE	=	EPA 608
ARSENIC	EPA 200.7		POLYCHLORINATED BII	PHENYLS (WATE	F EPA 608
BERYLLIUM	EPA 200.7				
CADMIUM	EPA 200.7				
CHROMIUM	EPA 200.7				
COBALT	EPA 200.7				
COPPER	EPA 200.7				
IRON	EPA 200.7				
LEAD .	EPA 200.7				
MANGANESE	EPA 200.7				
MOLYBDENUM	EPA 200.7				
NICKEL	EPA 200.7				
SILVER	EPA 200.7				
THALLIUM	EPA 200.7				
TITANIUM	EPA 200.7				
VANADIUM	EPA 200.7				
ZINC	EPA 200.7				
_ PH	SM 4500-H-B				
SPECIFIC CONDUCTIVITY	EPA 120.1				
TOTAL DISSOLVED SOLIDS	EPA 160.1				
TOTAL HARDNESS (CACO3)	SM 2340B				
MAGNESIUM	EPA 200.7				
POTASSIUM	EPA 200.7				
TOTAL ALKALINITY	EPA 310.1				
FLUORIDE	EPA 340.2				
AMMONIA-N	EPA 350.1				
CHEMICAL OXYGEN DEMAND	EPA 410.4				
BIOCHEMICAL OXYGEN DEMAND	SM 5210B			·	
TOTAL ORGANIC CARBON	SM 5310C				
TOTAL CYANIDE	SM 4500-CN-C, E	Ē			
NON-FILTERABLE RESIDUE	EPA 160.2				
TOTAL RESIDUAL CHLORINE	SM 4500-CL-B				
OIL AND GREASE	EPA 413.1				
VOLATILE HALOCARBONS	EPA 624				
VOLATILE AROMATICS	EPA 624				
CHLORDANE	EPA 508				
ALDRIN	EPA 608				
DIELORIN	EPA 608				
DOD	EPA 608				
DDE	EPA 608				,
DDT	EPA 608				

anuary 21, 2003

* Provisional Certification

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Certified Parameter List as of: 09 FEB 2003

SM 4500-CN-C,E

EPA 524.2 EPA 504.1

M-CT020

CYANIDE

TRIHALOMETHANES

1,2-DIBROMOETHANE

EAS LABORATORIES INC

WATERTOWN CT

POTABLE WATER (C	CHEMISTRY)	Effective Date	09 FEB 2003	Expiration Date	30 JUN 2003
	Analytes and Methods				
ARSENIC	EPA 200.9				
BARIUM	EPA 200.7				
BERYLLIUM	EPA 200.7				
CADMIUM	EPA 200.7				•
CHROMIUM	EPA 200.7				
COPPER	EPA 200.7				
MERCURY	EPA 245.1				
NICKEL	EPA 200.7				
SELENIUM	EPA 200.9				
THALLIUM	EPA 200.9				

Groundwater Analytical, Inc. P.O. Box 1200 228 Main Street Buzzards Bay, MA 02532 **GROUNDWATER ANALYTICAL**

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	Geolnsight, Inc.	Pages:	3
Fax:	19786921115	Date:	7/17/2003 10:26:10 AM
Re:		CC:	

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